2.2 Panel 2: Resource Availability

2.2.1 Panel Chair:

Karen Conover – R. Lynette & Associates, Redmond, Washington

Presentation charts follow

WIND RESOURCE ASSESSMENT AND PROJECT DEVELOPMENT POTENTIAL IN HAWAII

presented at:

Hawaii Wind Power Workshop

March 21-22, 1994

presented by:

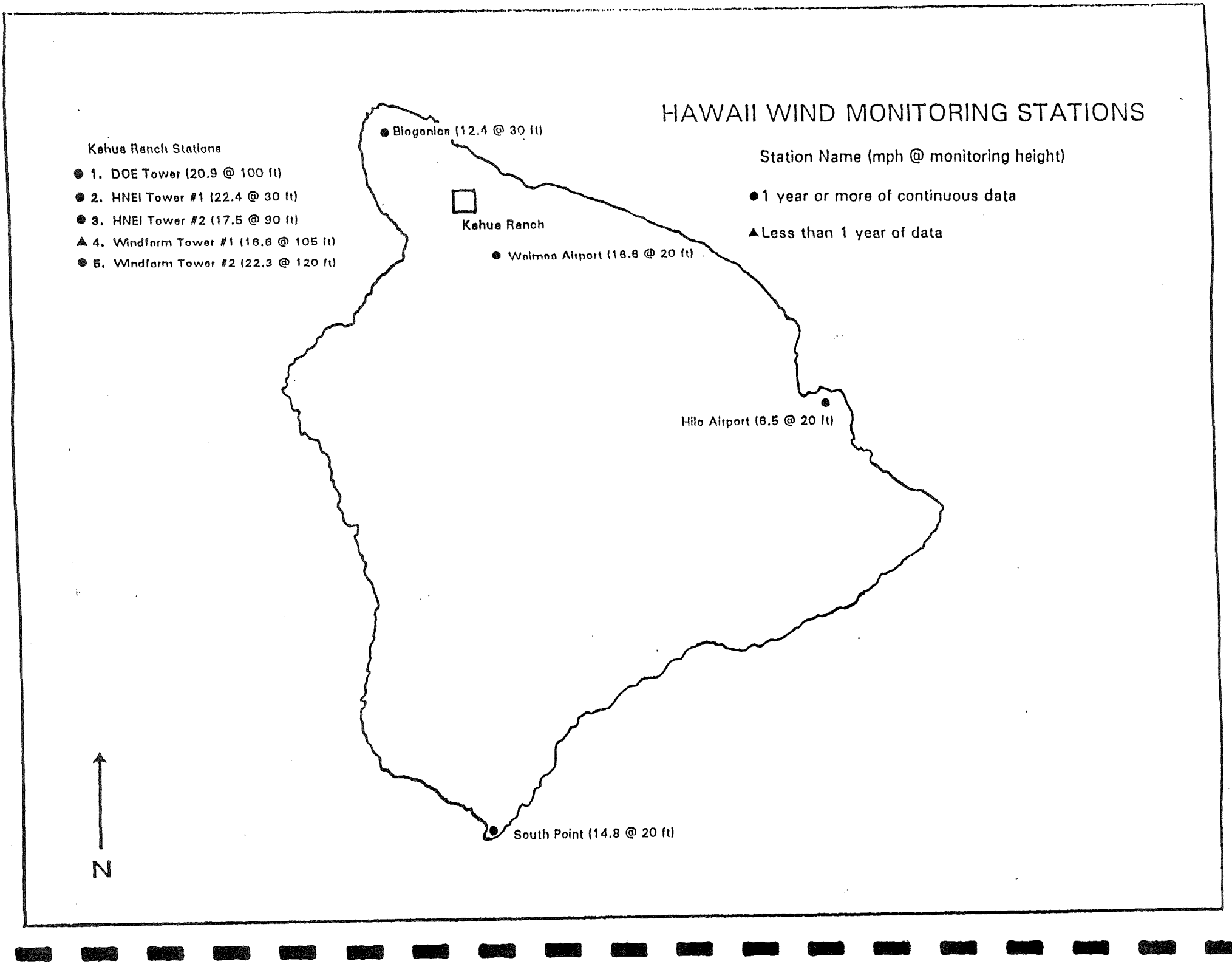
Karen Conover
R. Lynette & Associates, Inc.
15042 NE 40th Street, Suite 206
Redmond, Washington 98052-5353
Phone: (206) 885-0206
Fax: (206) 881-8468

SCOPE

- Past wind resource assessment work
- Existing projects
- Current wind resource assessment activities and preliminary results
- Potential project sites
- Land use issues

OVERVIEW OF PAST WIND RESOURCE ACTIVITIES

- Airports, military installations, and NWS
- University of Hawaii
  - Fixed stations
  - Mobile stations
- Wind Energy Resource Atlas
- U.S. DOE candidate sites
- Private developers and landowners
- Smaller assessments and/or single site measurements

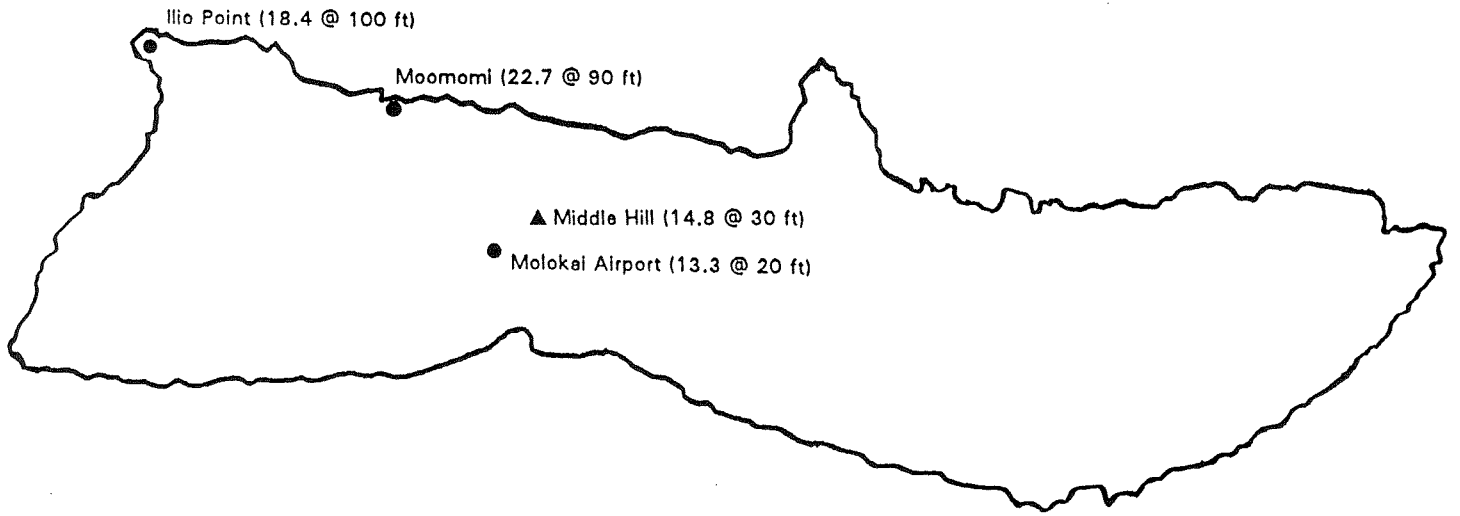

HAWAII WIND MONITORING STATIONS
Station Name (mph @ monitoring height)
●1 year or more of continuous data
▲Less than 1 year of data
Kahua Ranch Stations
● 1. DOE Tower (20.9 @ 100 ft)
● 2. HNEI Tower #1 (22.4 @ 30 ft)
● 3. HNEI Tower #2 (17.5 @ 90 ft)
▲ 4. Windfarm Tower #1 (16.6 @ 105 ft)
● 5. Windfarm Tower #2 (22.3 @ 120 ft)
● Biogenics (12.4 @ 30 ft)
Kahua Ranch
● Waimea Airport (16.6 @ 20 ft)
Hilo Airport (6.5 @ 20 ft)
South Point (14.8 @ 20 ft)
N

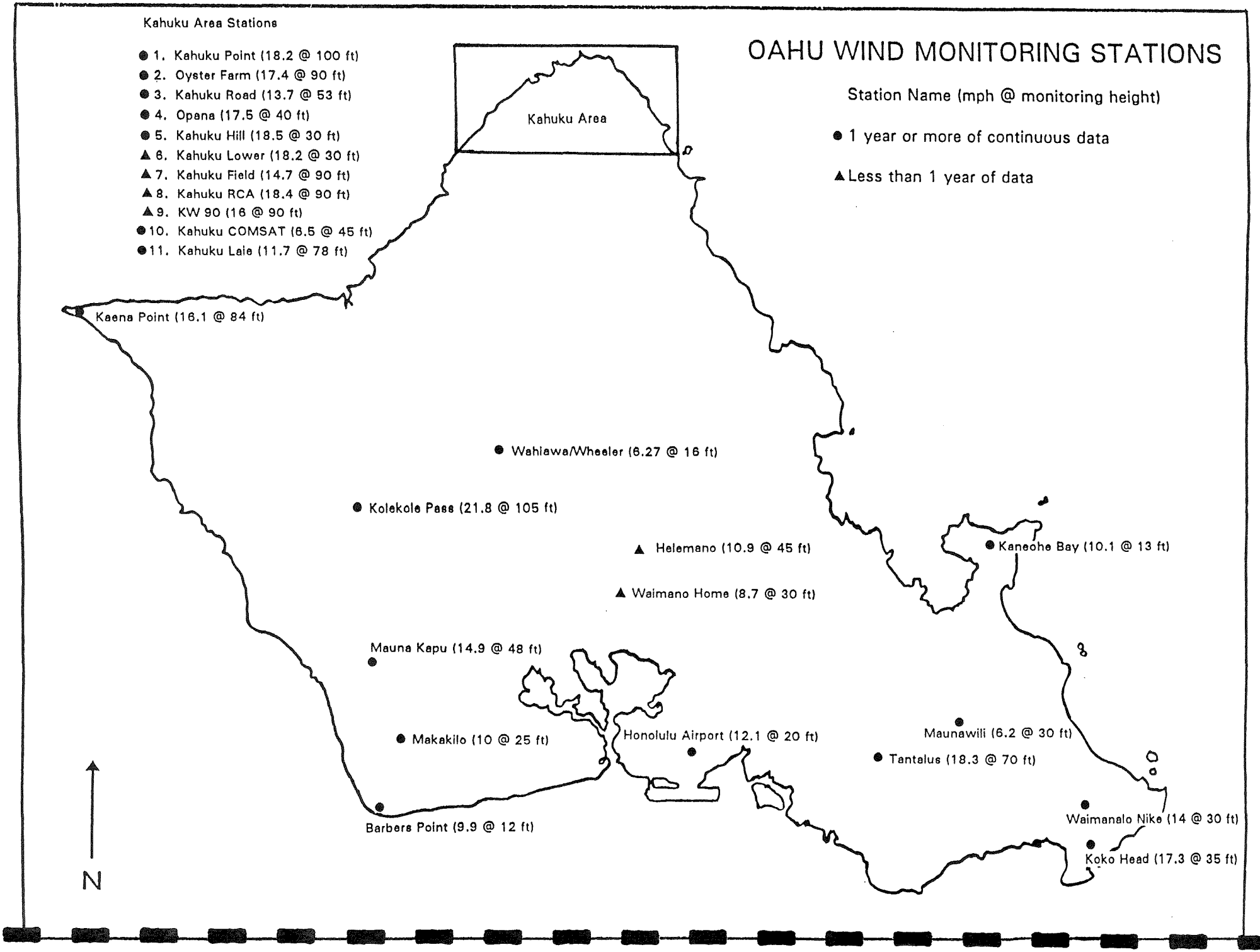
MOLOKAI WIND MONITORING STATIONS

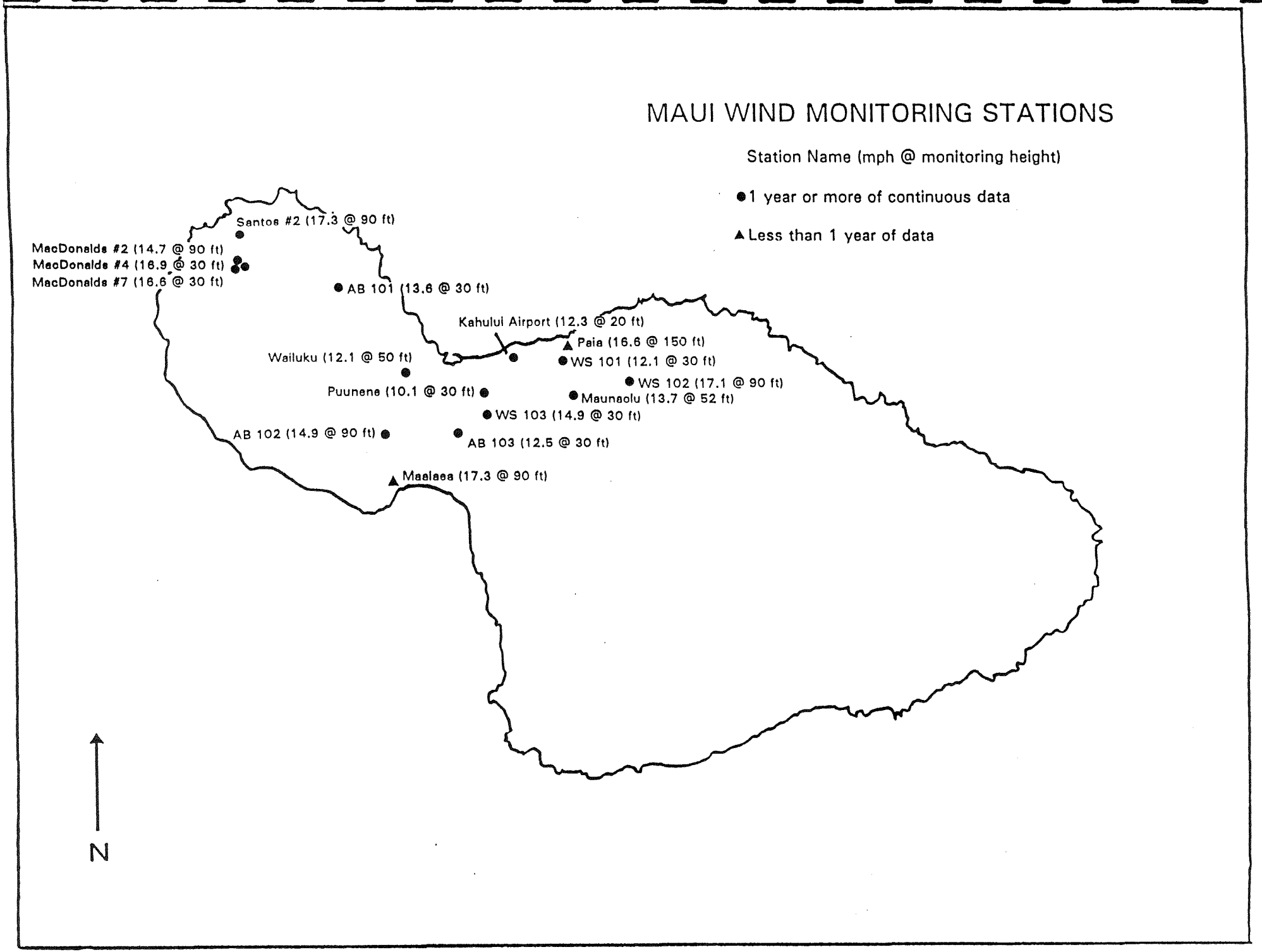
Station Name (mph @ monitoring height)

● 1 year or more of continuous data

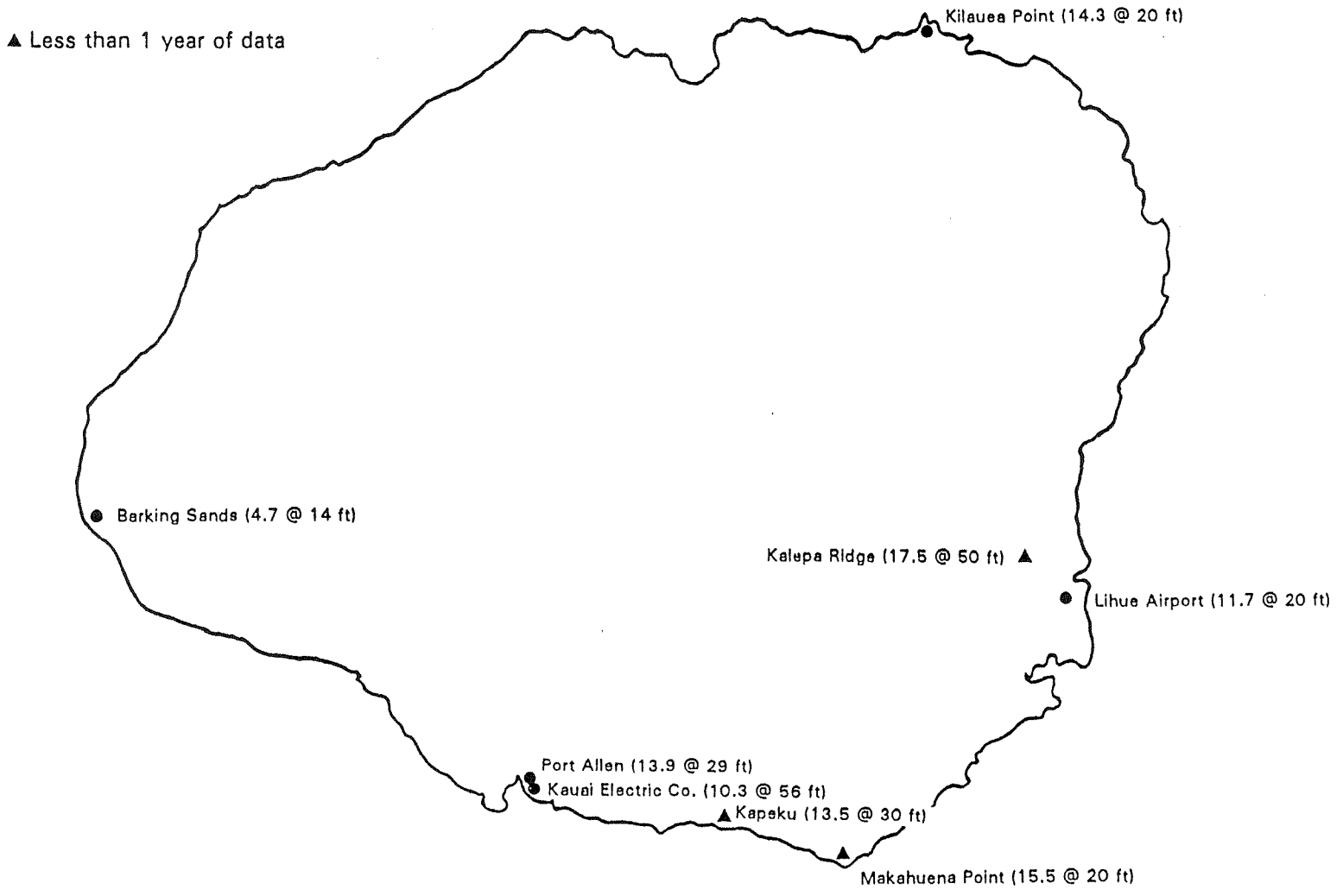
▲ Less than 1 year of data



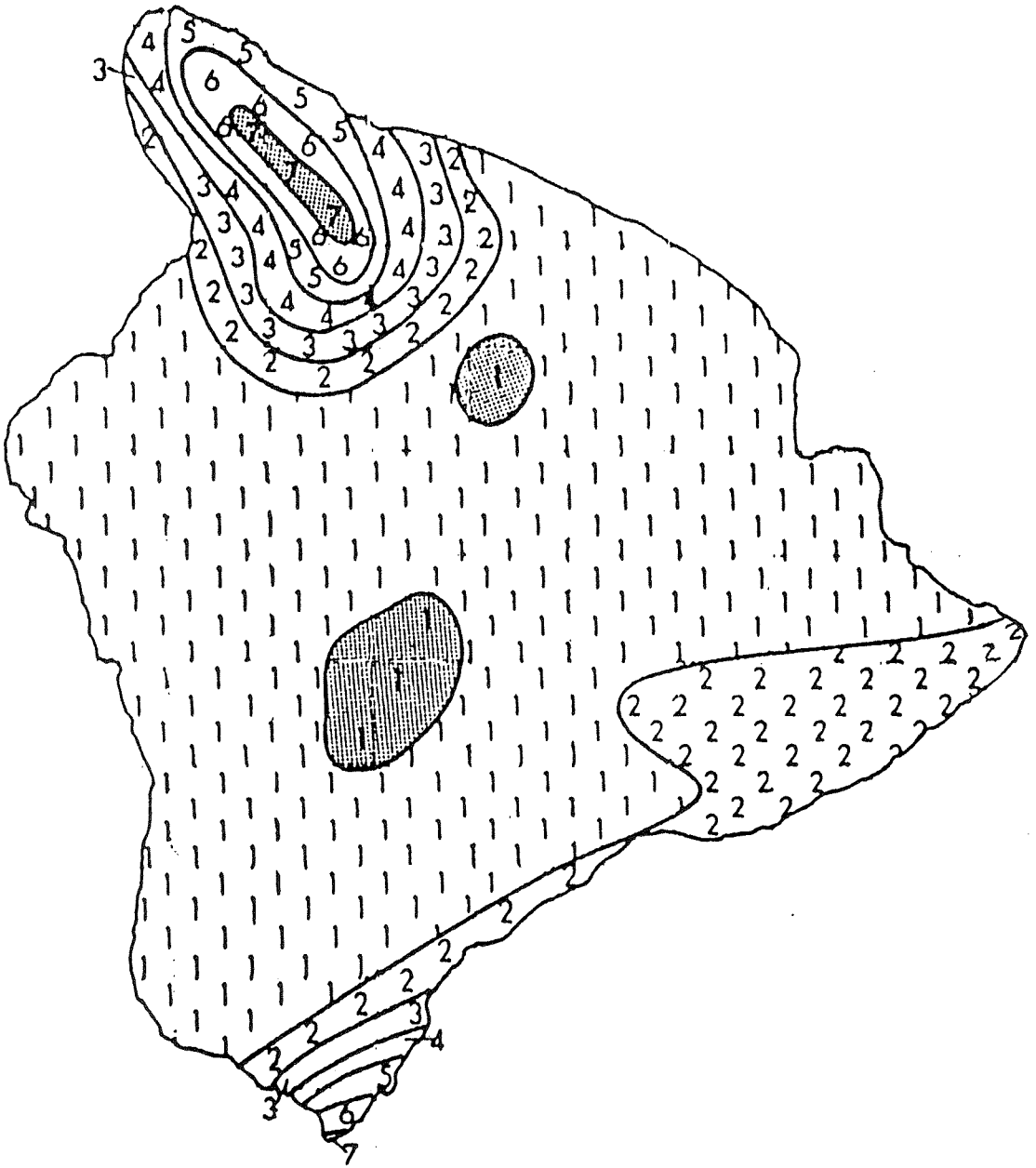

OAHU WIND MONITORING STATIONS
Station Name (mph @ monitoring height)
● 1 year or more of continuous data
▲ Less than 1 year of data
Kahuku Area Stations
● 1. Kahuku Point (18.2 @ 100 ft)
● 2. Oyster Farm (17.4 @ 90 ft)
● 3. Kahuku Road (13.7 @ 53 ft)
● 4. Opana (17.5 @ 40 ft)
● 5. Kahuku Hill (18.5 @ 30 ft)
▲ 6. Kahuku Lower (18.2 @ 30 ft)
▲ 7. Kahuku Field (14.7 @ 90 ft)
▲ 8. Kahuku RCA (18.4 @ 90 ft)
▲ 9. KW 90 (16 @ 90 ft)
● 10. Kahuku COMSAT (6.5 @ 45 ft)
● 11. Kahuku Lale (11.7 @ 78 ft)
Kahuku Area
Kaena Point (16.1 @ 84 ft)
● Wahiawa/Wheeler (6.27 @ 16 ft)
● Kolekole Pass (21.8 @ 105 ft)
▲ Helemano (10.9 @ 45 ft)
▲ Waimano Home (8.7 @ 30 ft)
● Kaneohe Bay (10.1 @ 13 ft)
Mauna Kapu (14.9 @ 48 ft)
● Makakilo (10 @ 25 ft)
Honolulu Airport (12.1 @ 20 ft)
Maunawili (6.2 @ 30 ft)
● Tantalus (18.3 @ 70 ft)
Barbers Point (9.9 @ 12 ft)
Waimanalo Nike (14 @ 30 ft)
Koko Head (17.3 @ 35 ft)
N


MAUI WIND MONITORING STATIONS
Station Name (mph @ monitoring height)
● 1 year or more of continuous data
▲ Less than 1 year of data
Santos #2 (17.3 @ 90 ft)
MacDonalds #2 (14.7 @ 90 ft)
MacDonalds #4 (16.9 @ 30 ft)
MacDonalds #7 (16.6 @ 30 ft)
AB 101 (13.6 @ 30 ft)
Kahului Airport (12.3 @ 20 ft)
Paia (16.6 @ 150 ft)
Wailuku (12.1 @ 50 ft)
WS 101 (12.1 @ 30 ft)
WS 102 (17.1 @ 90 ft)
Puunene (10.1 @ 30 ft)
Maunaolu (13.7 @ 52 ft)
WS 103 (14.9 @ 30 ft)
AB 102 (14.9 @ 90 ft)
AB 103 (12.5 @ 30 ft)
Maalaea (17.3 @ 90 ft)
N

KAUAI WIND MONITORING STATIONS

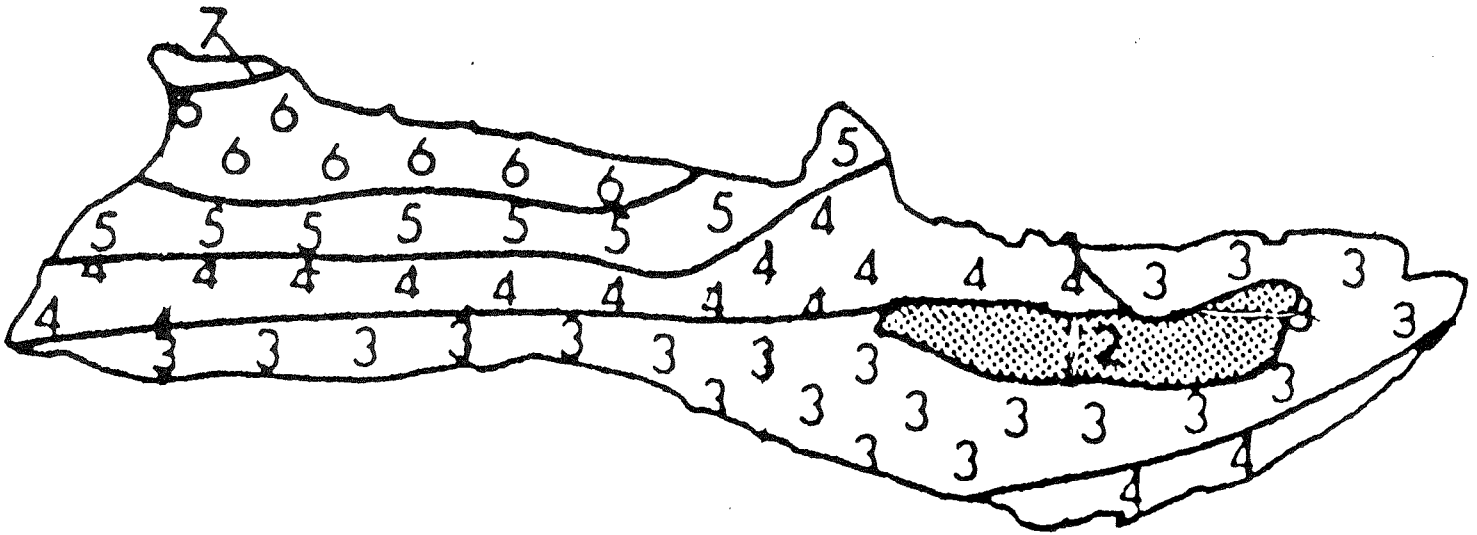


Hawaii Wind Resource Map



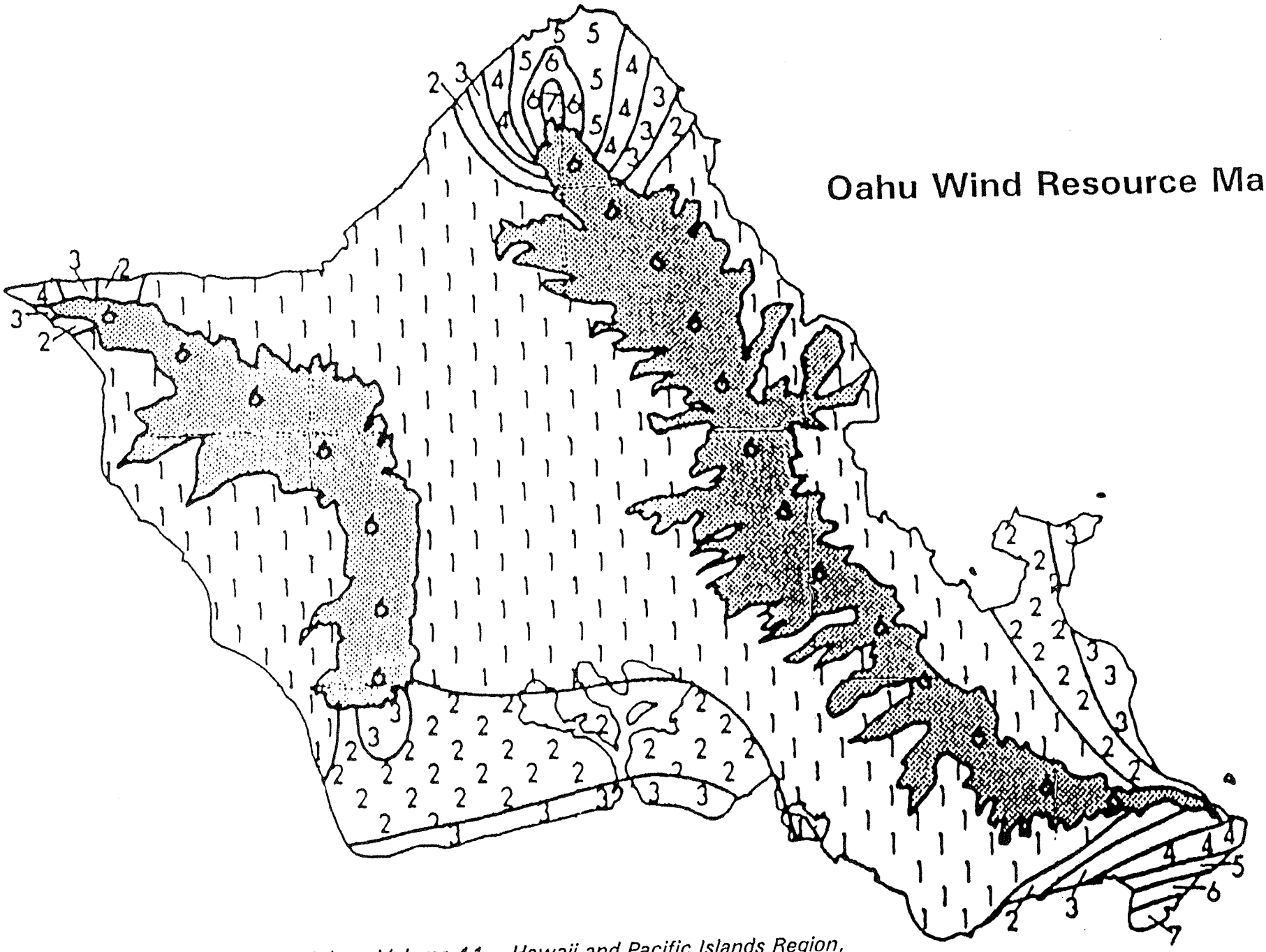
Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region,* Battelle Pacific Northwest Laboratories, February 1981

Molokai Wind Resource Map



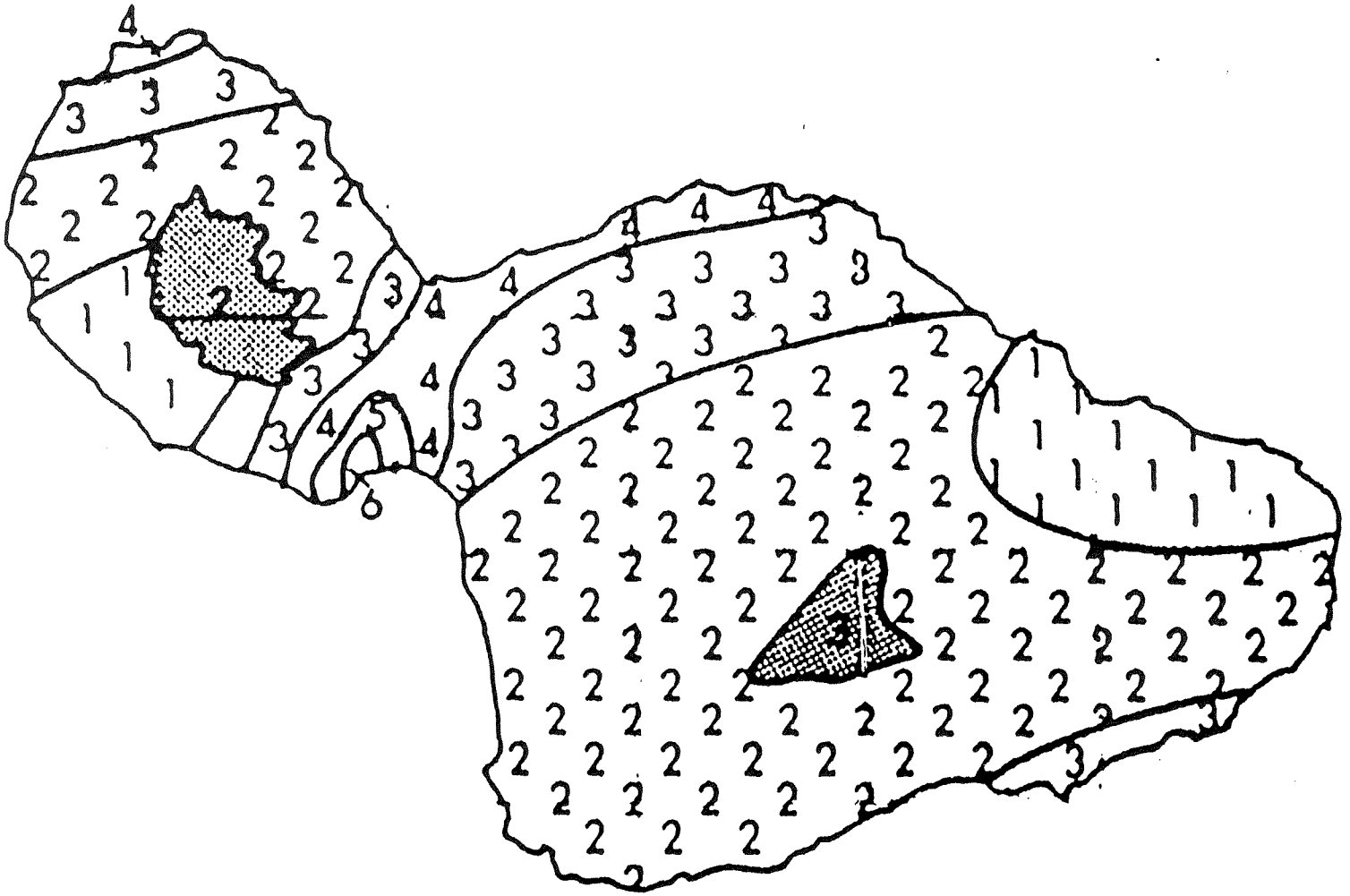
Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region,* [redacted]

Oahu Wind Resource Map



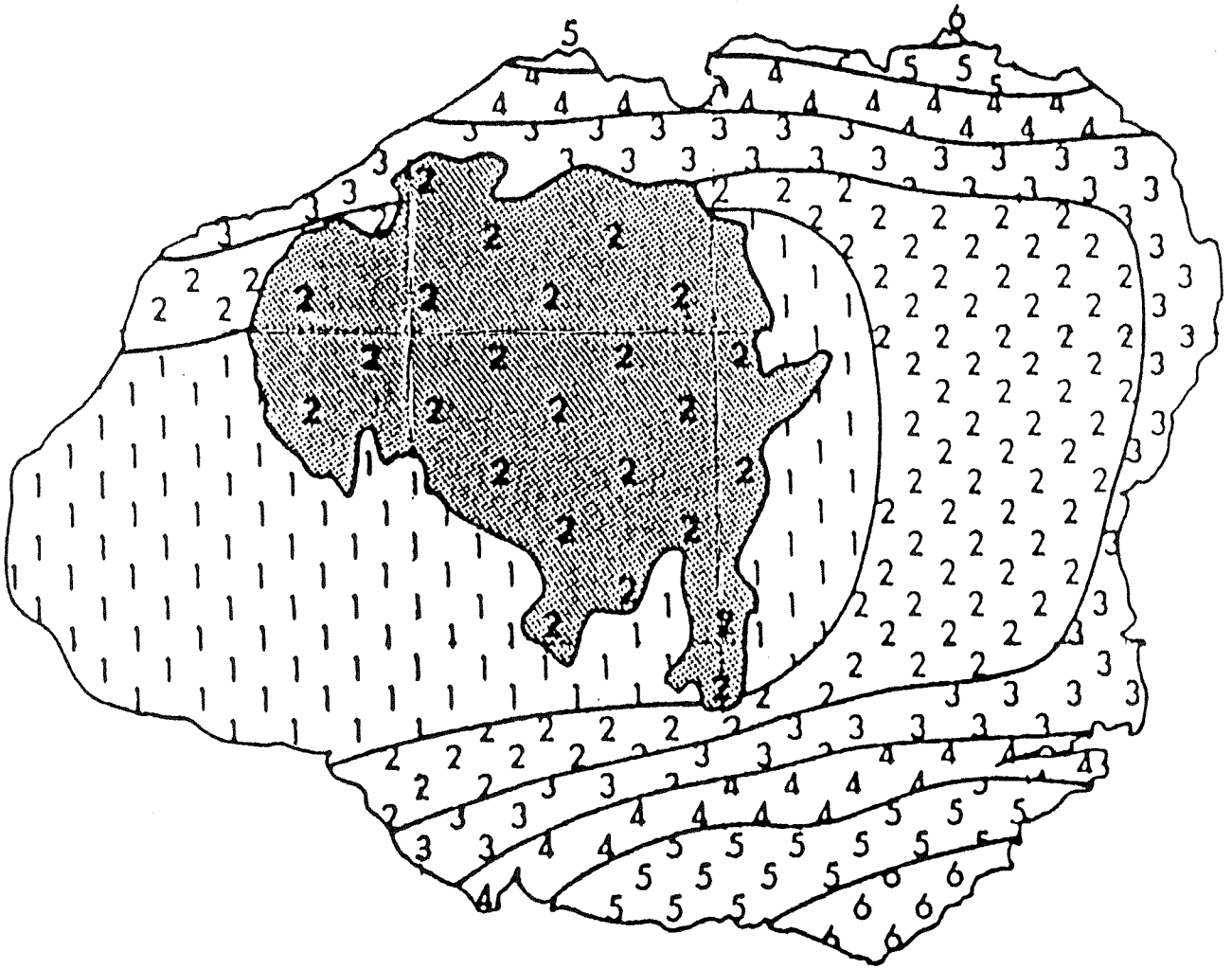
Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region,* Battelle Pacific Northwest Laboratories, February 1981

Maui Wind Resource Map



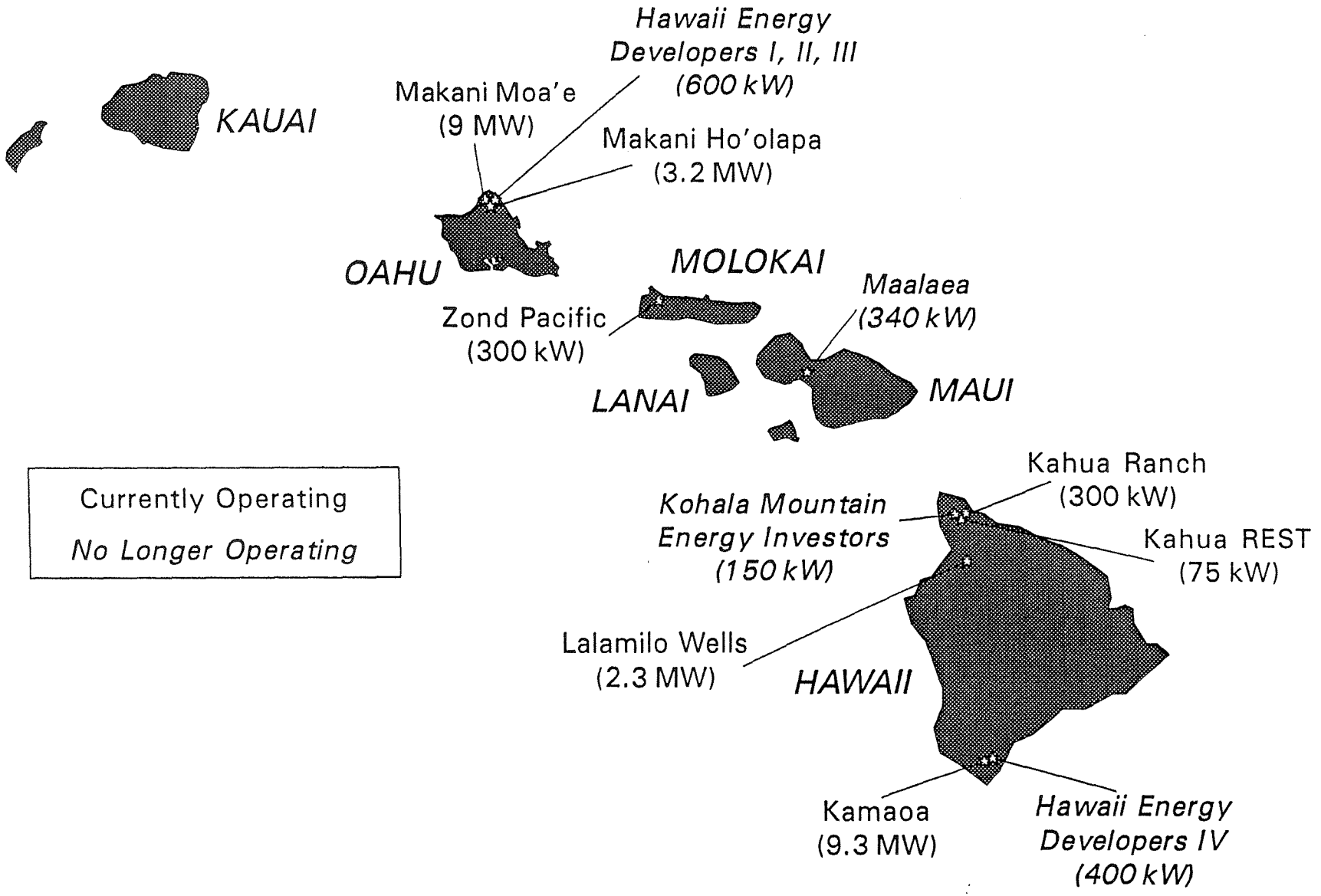
Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region*, Battelle Pacific Northwest Laboratories, February 1981.

Kauai Wind Resource Map



Source: *Wind Energy Resource Atlas: Volume 11 – Hawaii and Pacific Islands Region*, Battelle Pacific Northwest Laboratories, February 1981

Wind Power Stations in Hawaii



CURRENT ACTIVITIES

Hawaii Energy Strategy
Renewable Energy Resource and Development Program

- Phase 1: Renewable Energy Resource Assessment Plan

  Better define the viable locations for project development

- Phase 2: Renewable Energy Resource Supply Curves

  Develop cost and performance data

- Phase 3: Data Collection and Implementation Plan

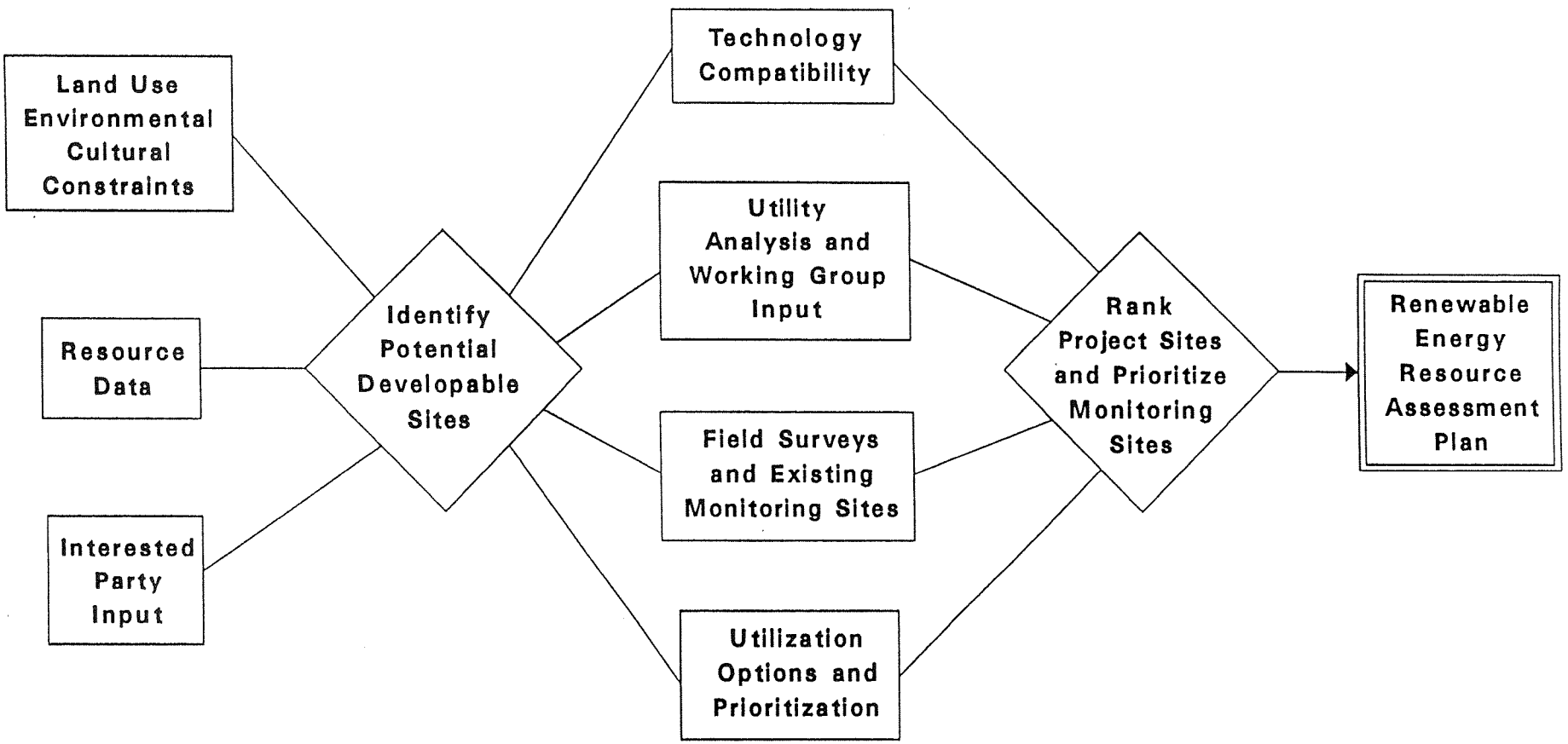
  Obtain additional wind and solar data and identify goals and methodologies for integrating renewables into the state's generation mix

- Technologies: wind, solar thermal, photovoltaics, biomass, hydro, wave, OTEC

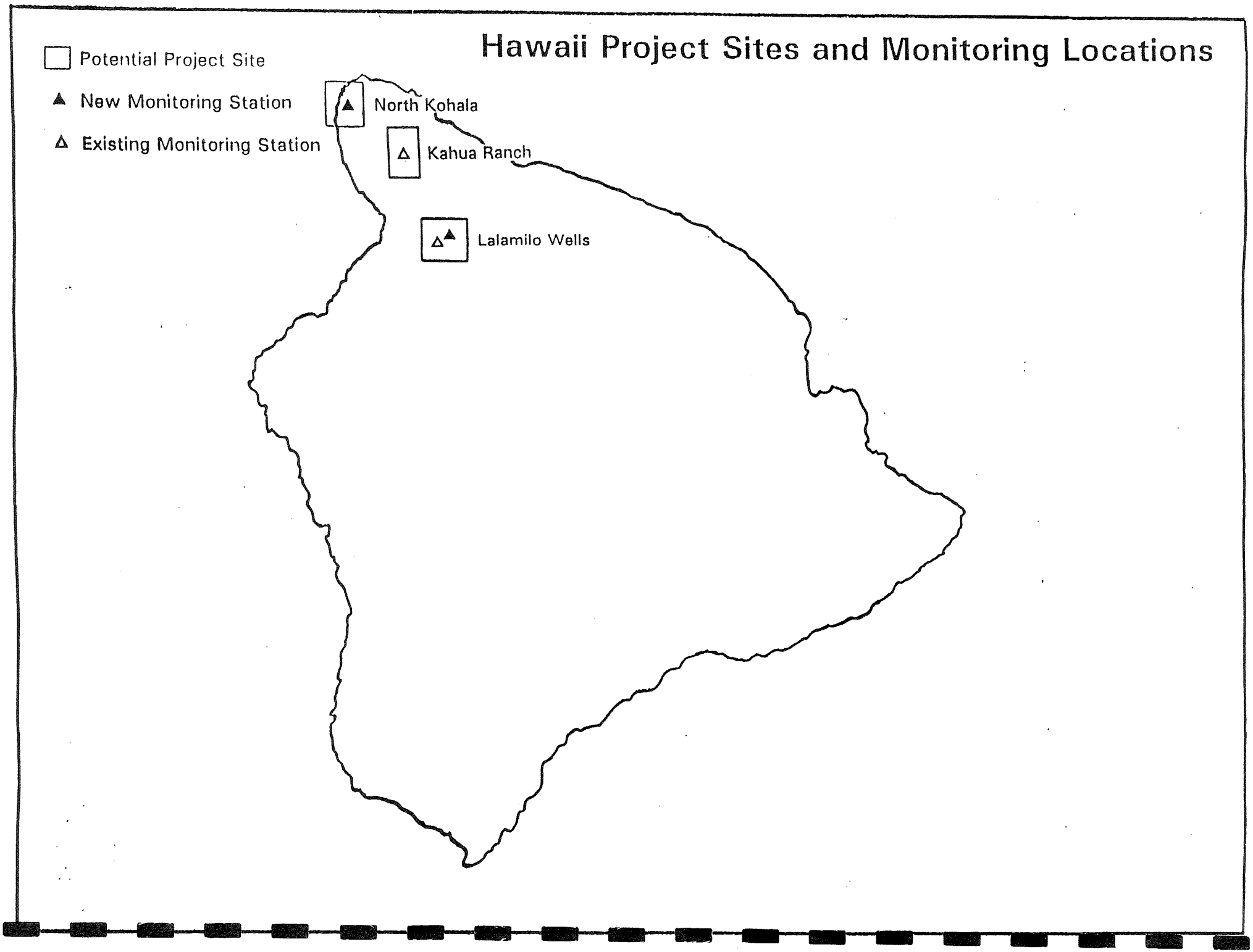
PHASE 1

- Identify constraints and requirements for renewable energy projects in Hawaii
- Apply screening process to identify most promising project locations
  - Resource intensity
  - Land zoning
  - Terrain suitability
  - Competing land uses
  - Owner acceptance
  - Utility access and impact
  - Environmental and cultural sensitivity
  - Public acceptance

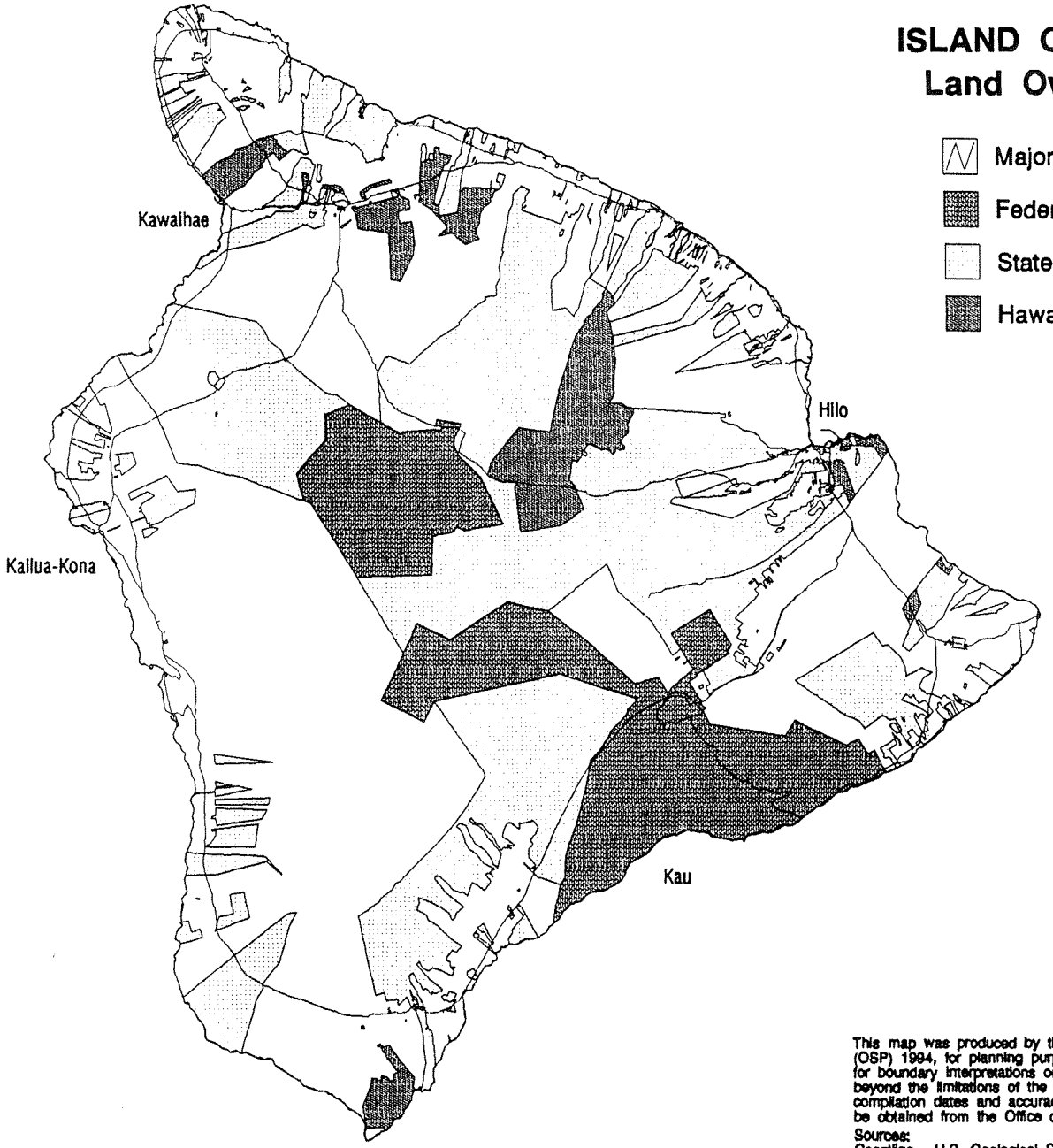
RENEWABLE ENERGY RESOURCE ASSESSMENT PLAN, PHASE 1



Hawaii Project Sites and Monitoring Locations



ISLAND OF HAWAII
Land Ownership



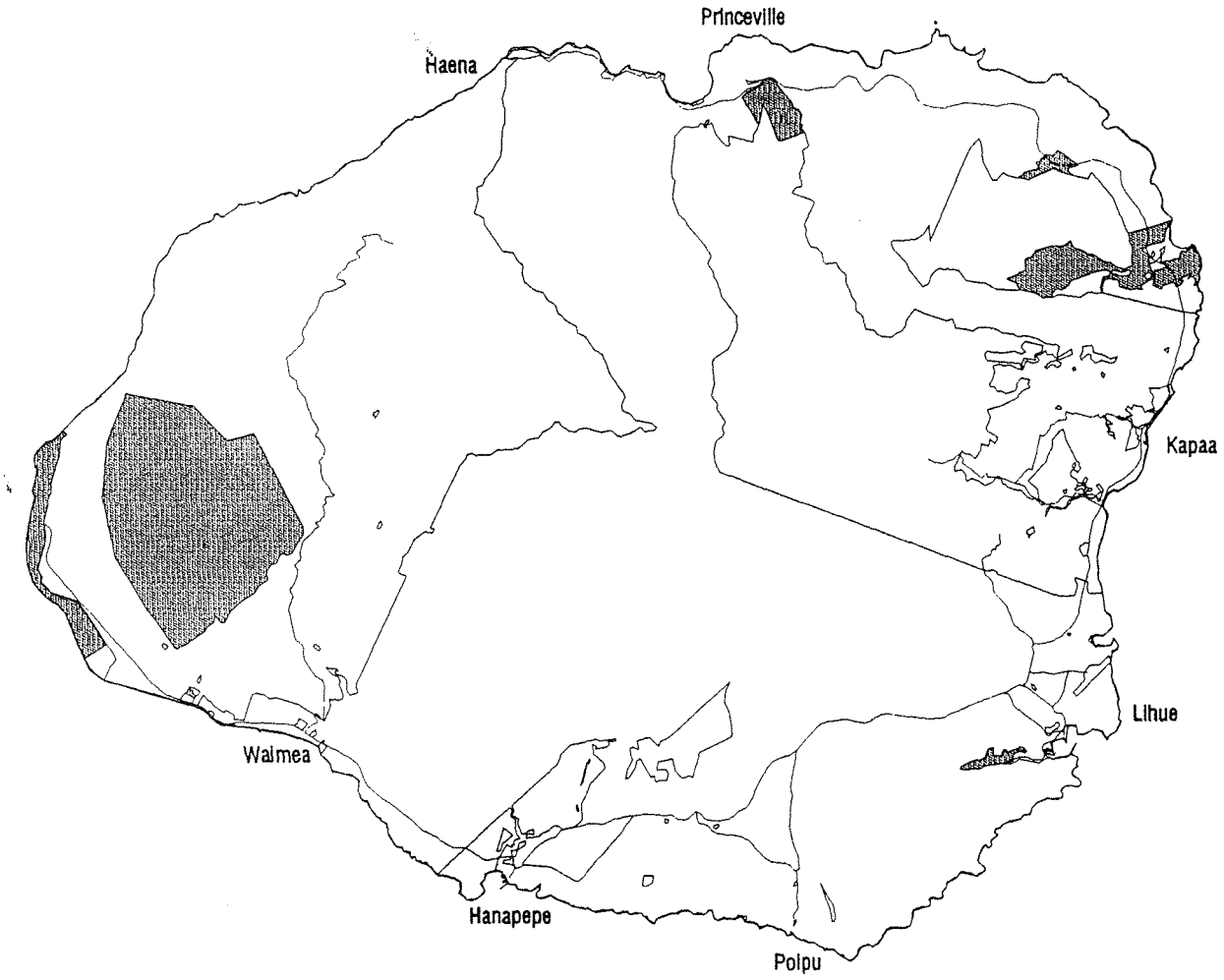
- Major Roads
- Federal Lands
- State Lands
- Hawaiian Home Lands

1 : 900,000

This map was produced by the Office of State Planning, (OSP) 1994, for planning purposes. It should not be used for boundary interpretations or other spatial analysis beyond the limitations of the data. Information regarding compilation dates and accuracy of the data presented can be obtained from the Office of State Planning.

Sources:
Coastline - U.S. Geological Survey DLG files 1:24,000 1983.
Land Ownership - U.S. Geological Survey digital GIRAS files 1:100,00 1976.
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

ISLAND OF KAUAI
Land Ownership



- Major Roads
- Federal Lands
- State Lands
- Hawaiian Home Lands

1 : 825,000

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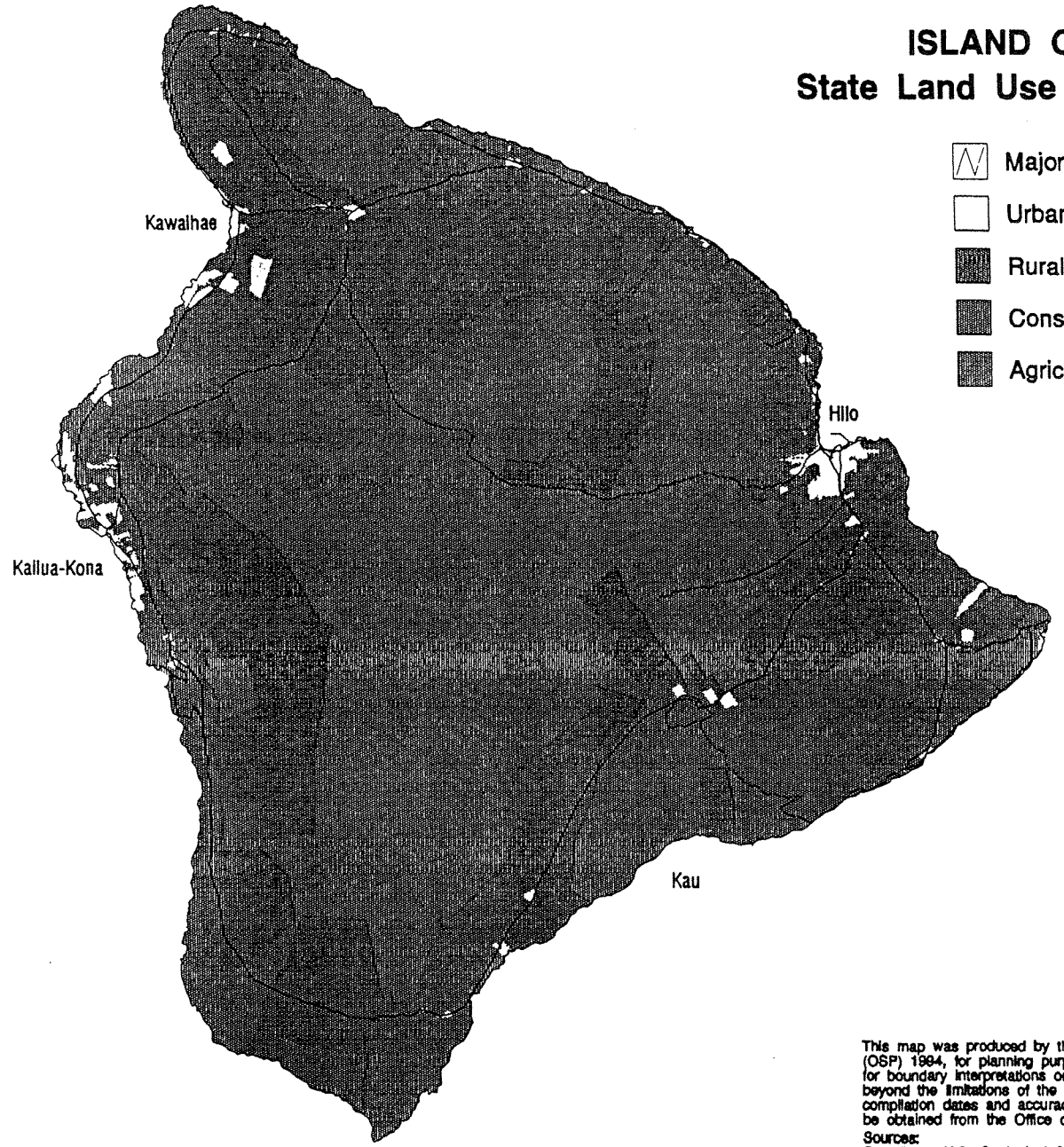
ISLAND OF HAWAII
State Land Use District Boundaries



- Major Roads
- Urban
- Rural
- Conservation
- Agriculture

1 : 900,000

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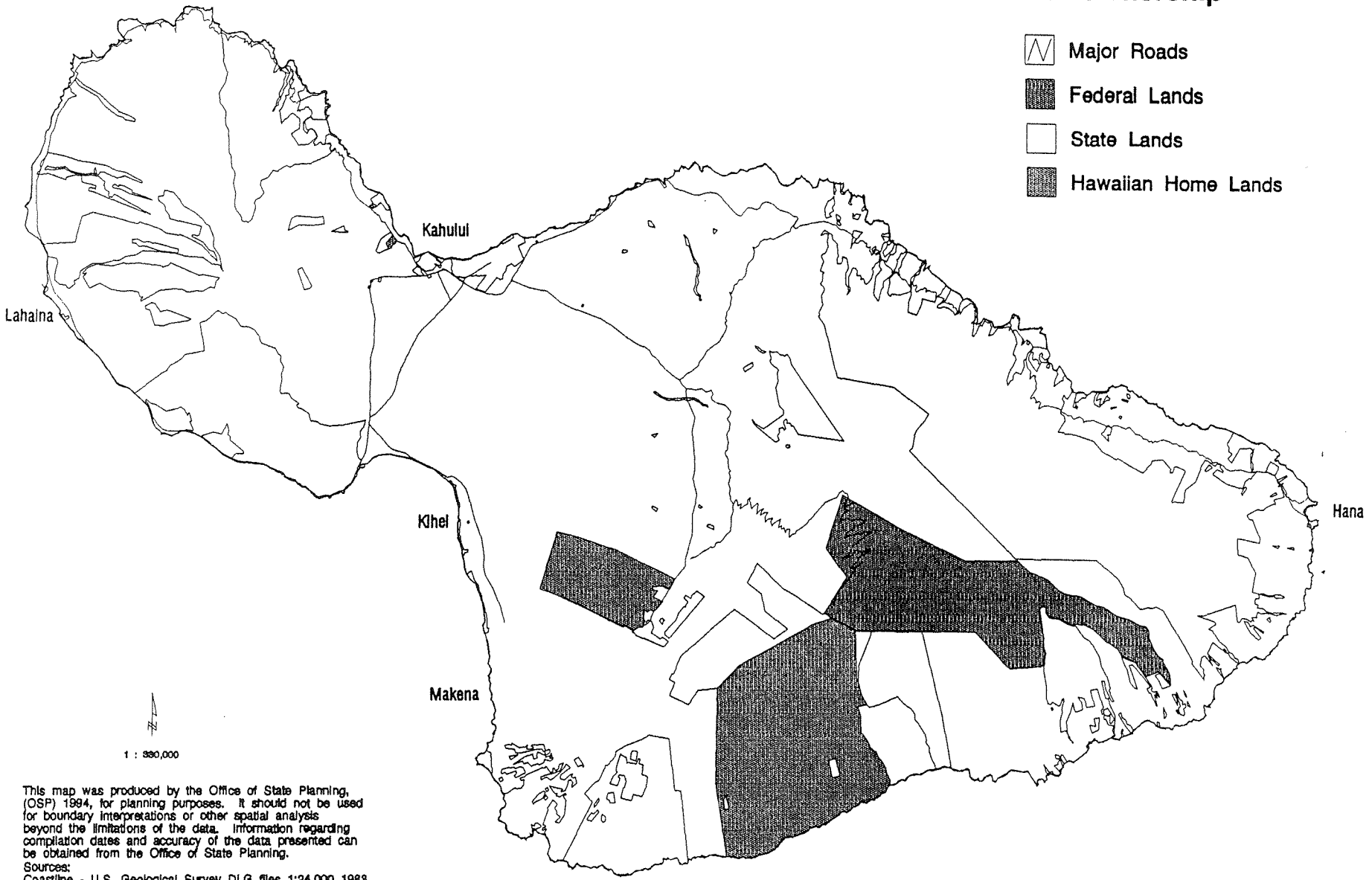
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

ISLAND OF MAUI
Land Ownership



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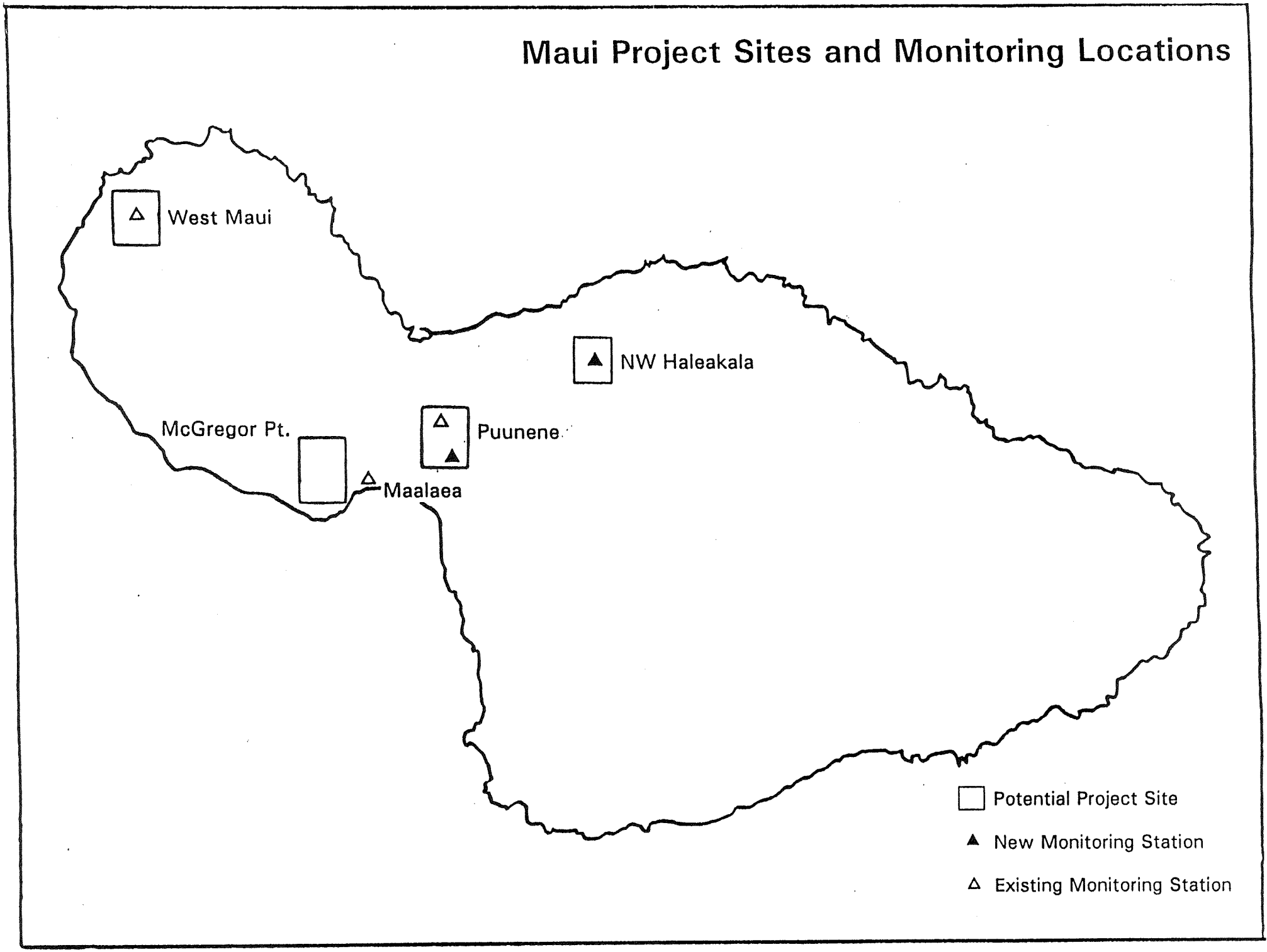
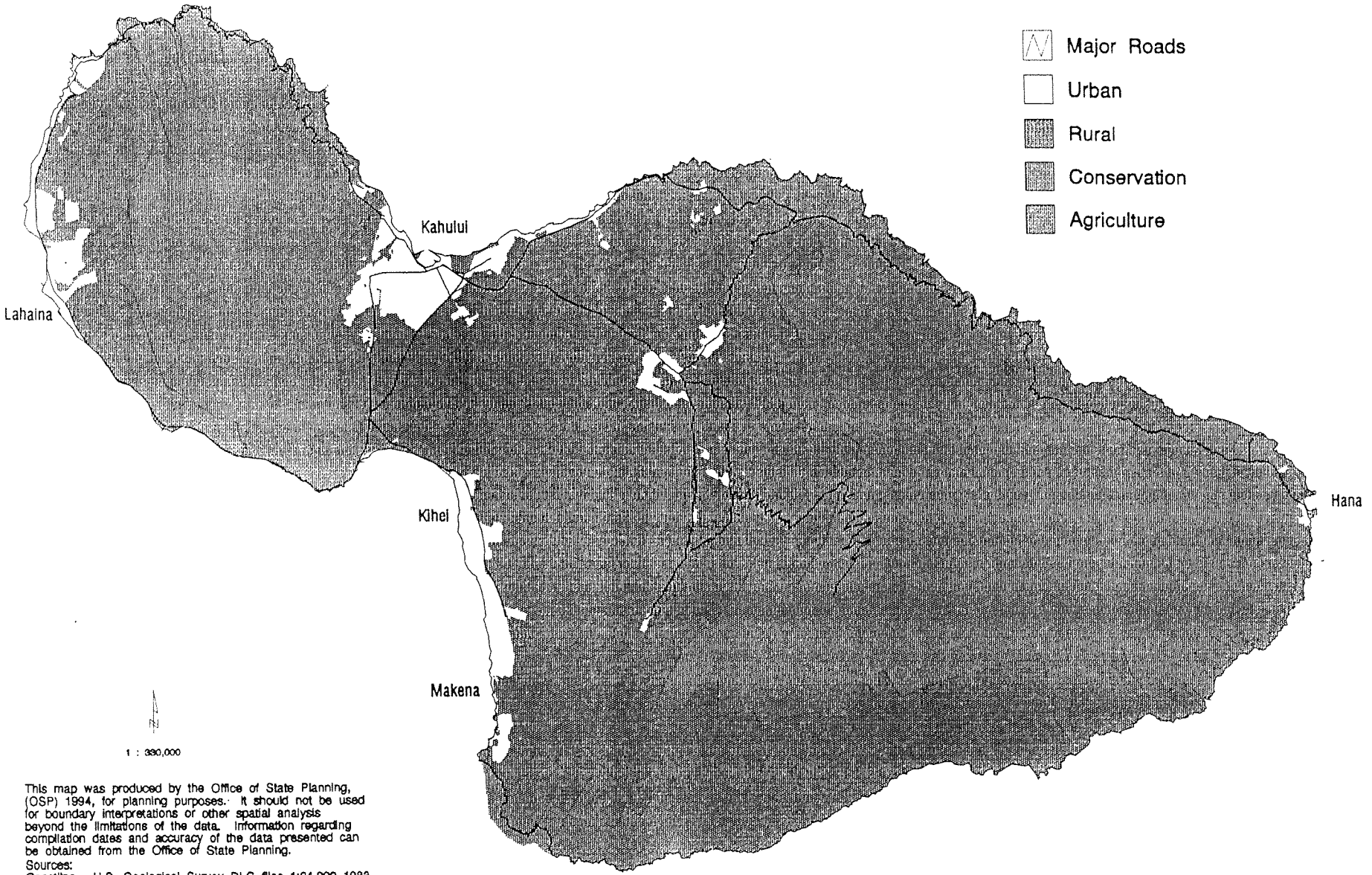
Roads - U.S. Geological Survey DLG files 1:24,000 1983.


Maui Project Sites and Monitoring Locations
West Maui
NW Haleakala
McGregor Pt.
Puunene
Maalaea
Potential Project Site
New Monitoring Station
Existing Monitoring Station

ISLAND OF MAUI
State Land Use District Boundaries



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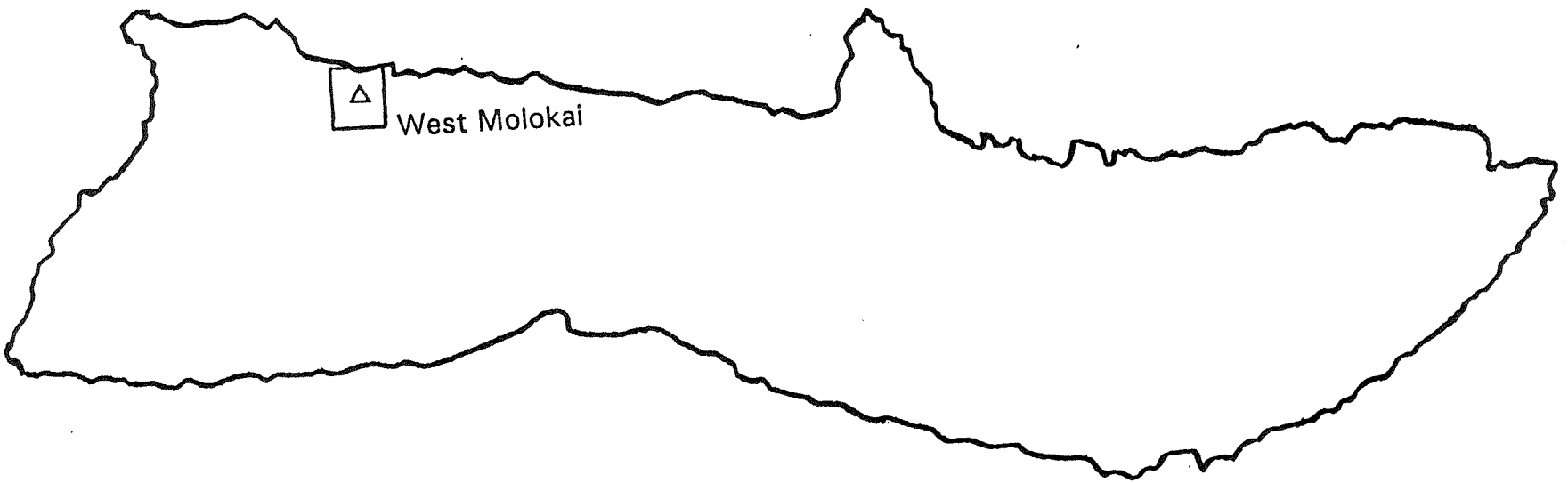
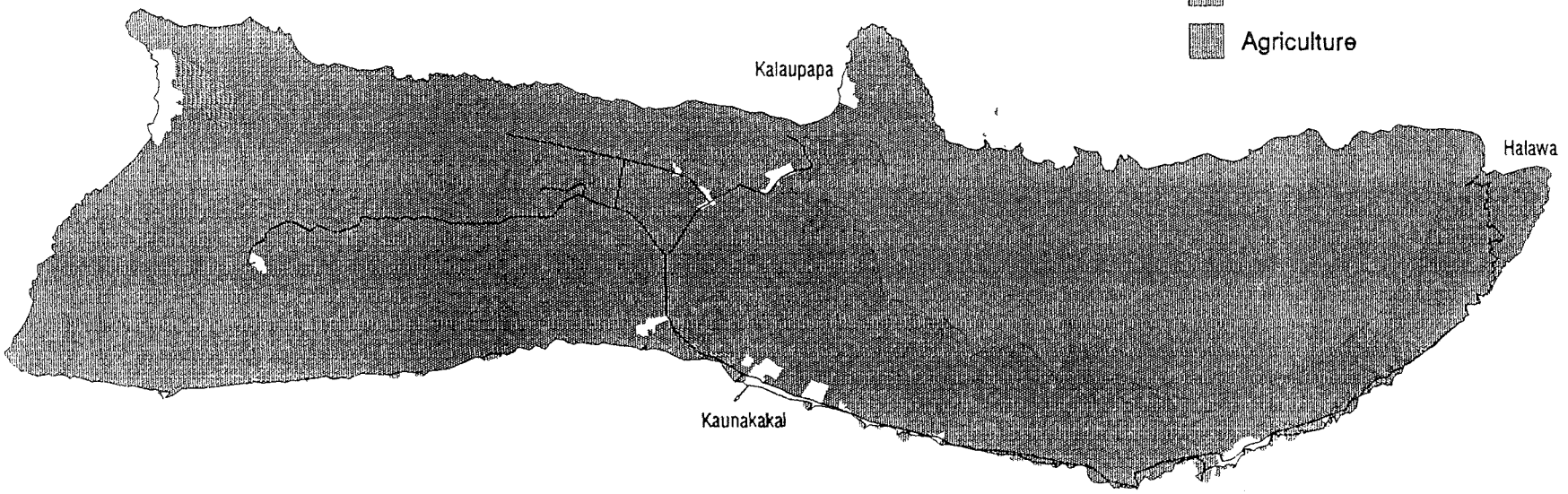
Molokai Project Sites and Monitoring Locations

Potential Project Site

Existing Monitoring Station



ISLAND OF MOLOKAI
State Land Use District Boundaries



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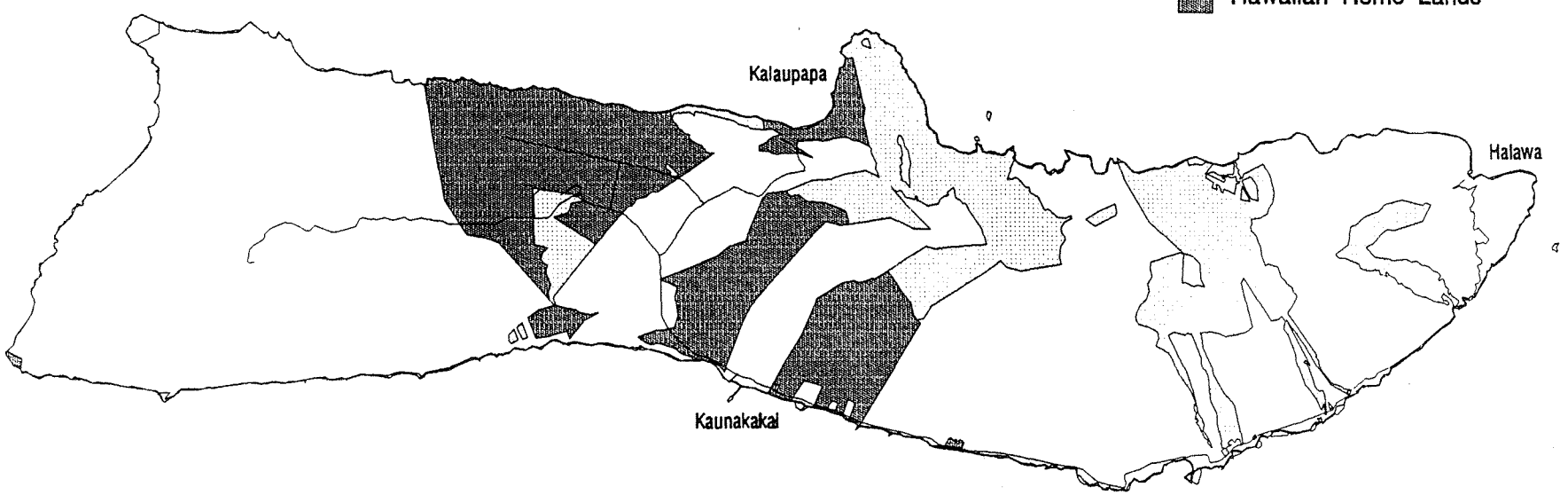
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

ISLAND OF MOLOKAI
Land Ownership



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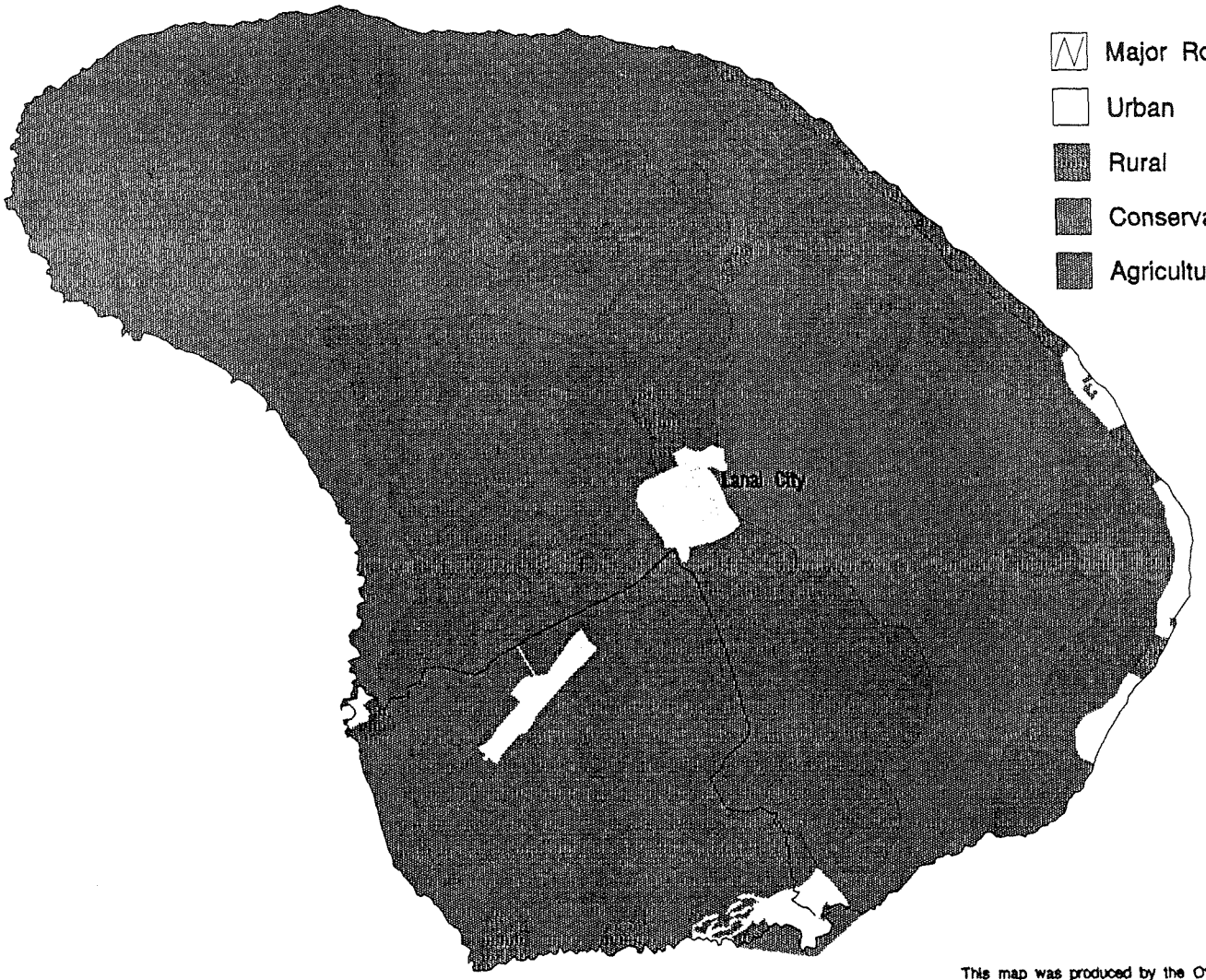
Land Ownership - U.S. Geological Survey digital GIRAS files 1:100,00 1976.
Roads - U.S. Geological Survey DLG files 1:24,000 1983.

ISLAND OF LANAI
State Land Use District Boundaries



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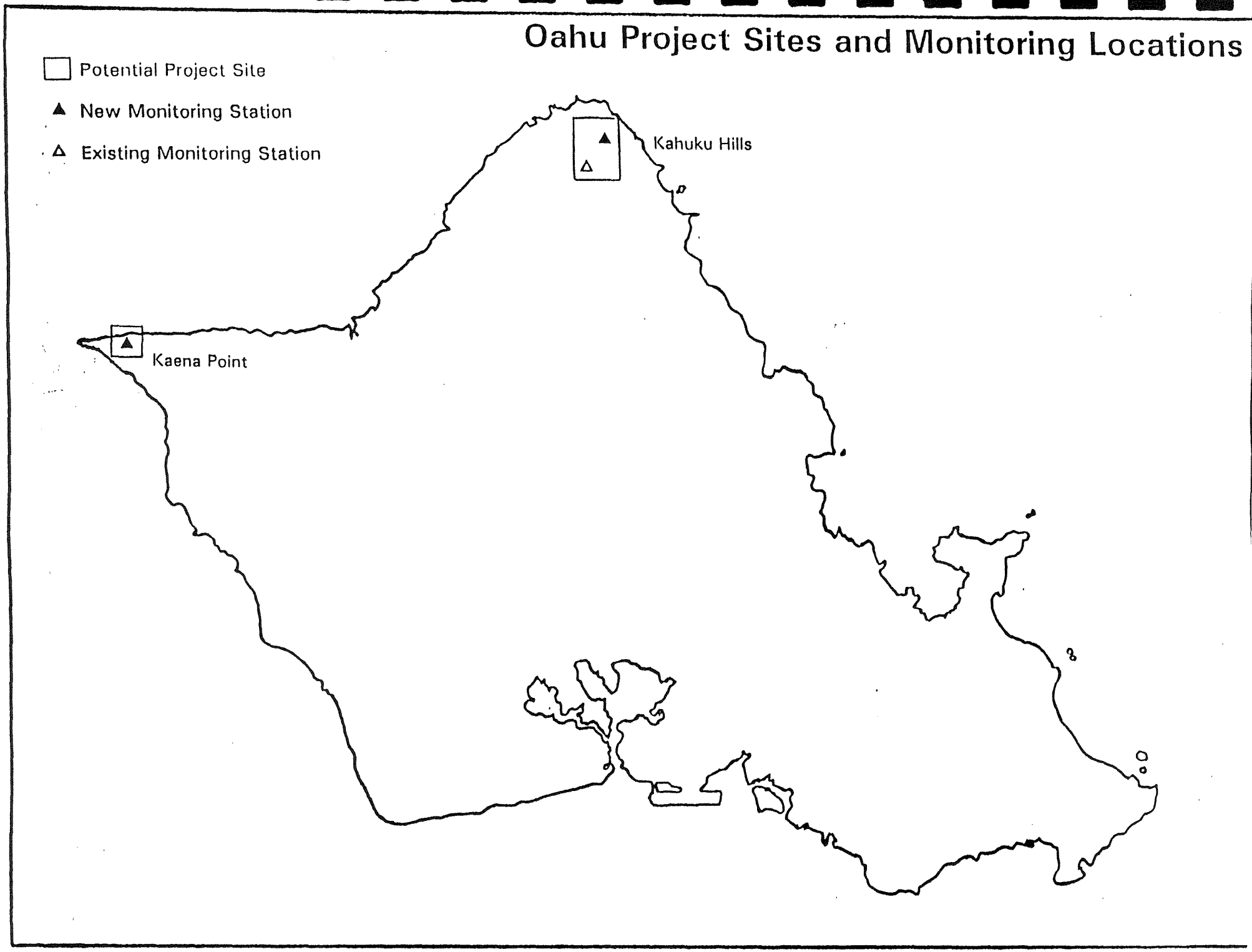
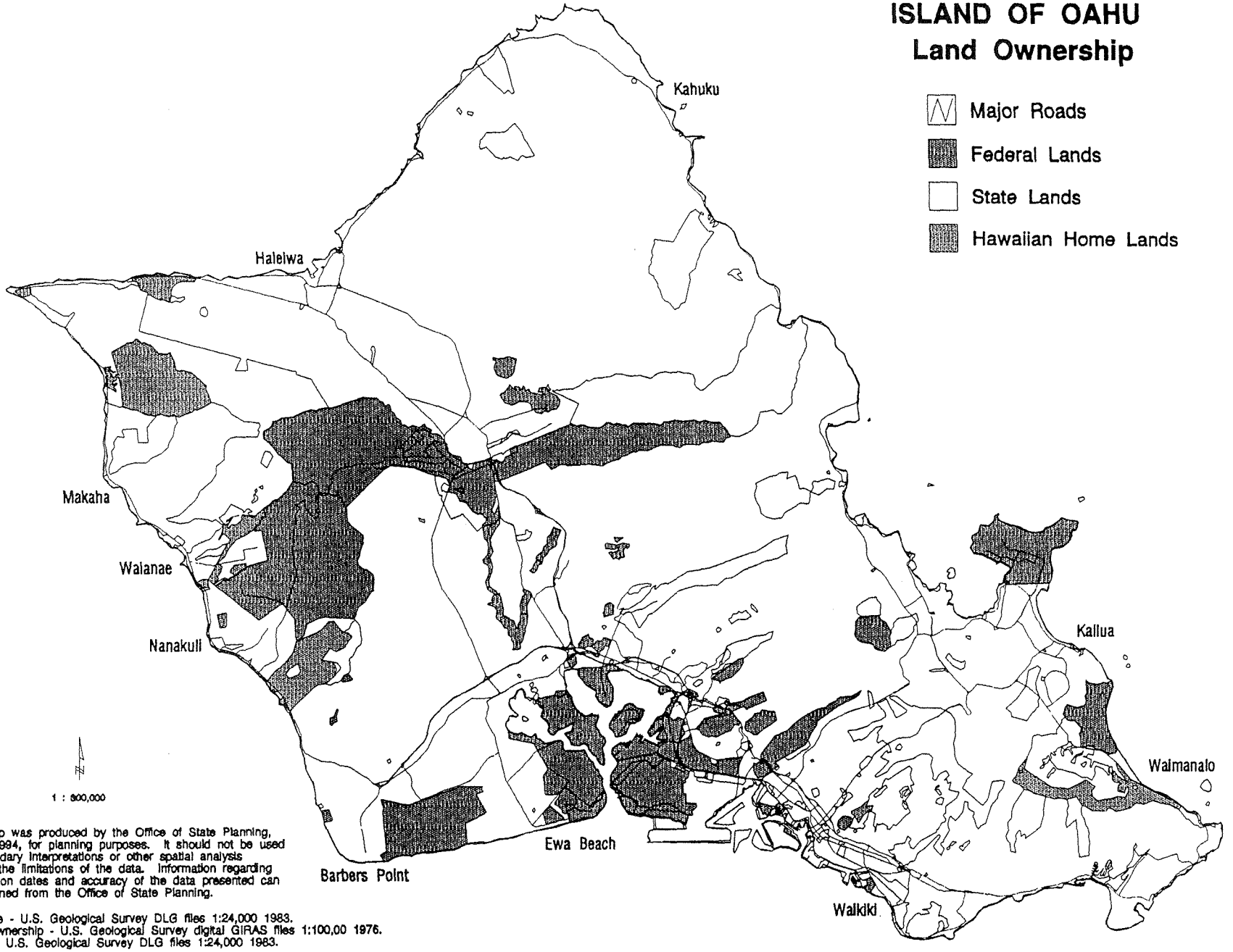
Oahu Project Sites and Monitoring Locations



ISLAND OF OAHU
Land Ownership



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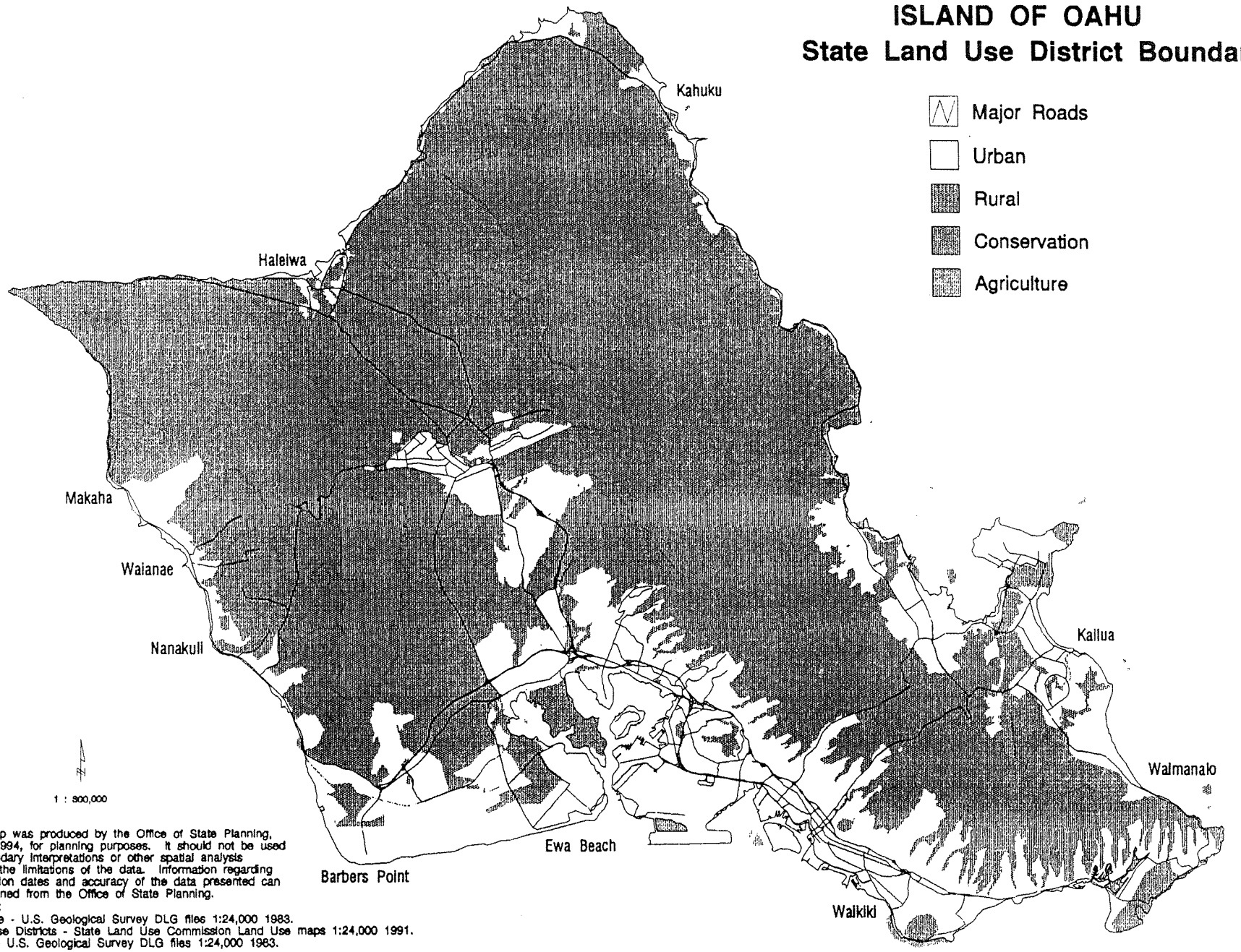
ISLAND OF OAHU
State Land Use District Boundaries



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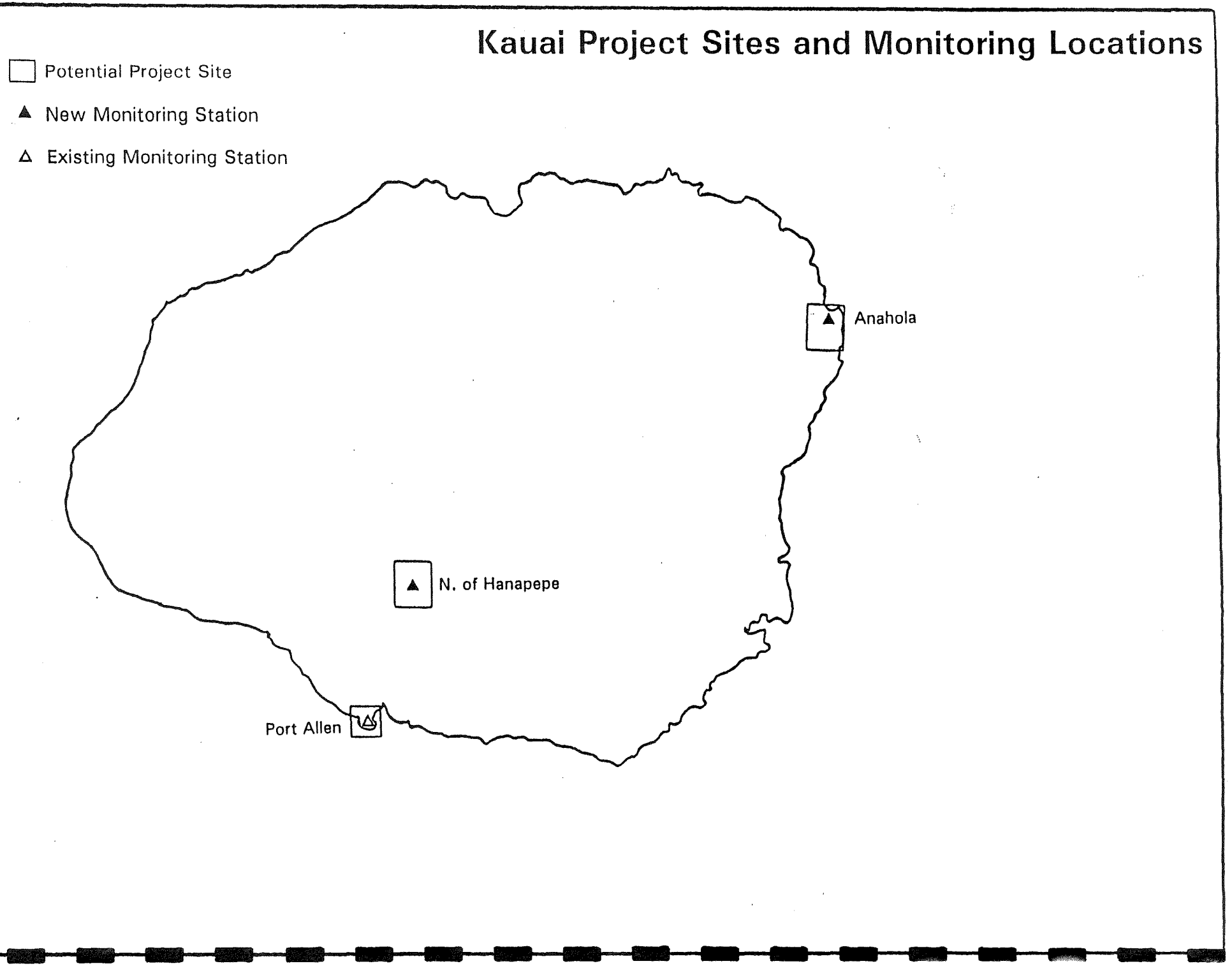
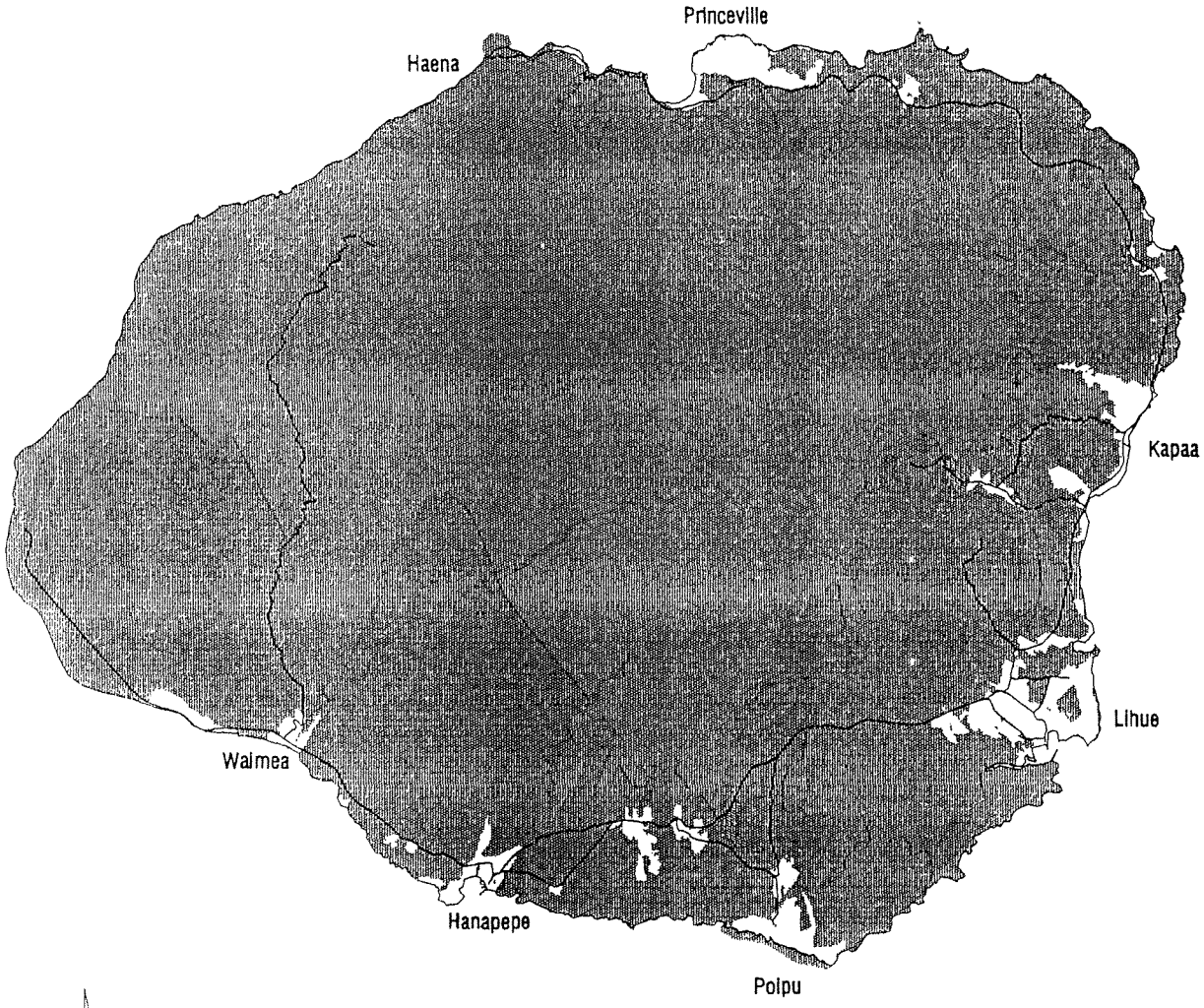
Kauai Project Sites and Monitoring Locations



ISLAND OF KAUAI
State Land Use District Boundaries



- Major Roads
- Urban
- Rural
- Conservation
- Agriculture

1 : 825,000

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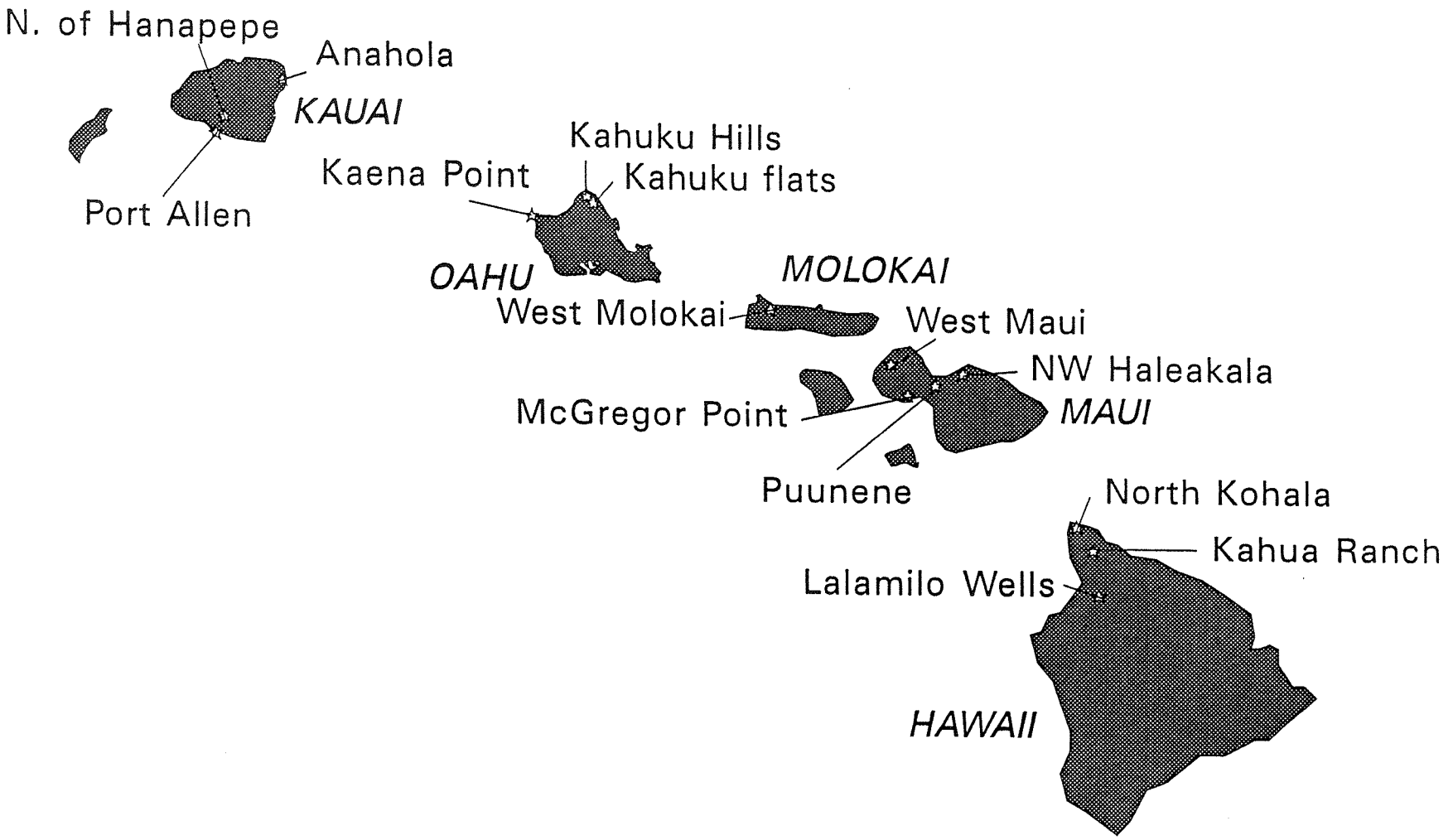
Location of Potential Project Sites



LAND-USE CHARACTERISTICS OF POTENTIAL PROJECT SITES

	Sites	Owner	Zoning	Current/Planned Uses
Hawaii	Lalamilo	State	Agriculture	Grazing, Water Dept. wells
	N. Kohala	Chalon Int'l	Agriculture	Renewable energy, resort development, & residences
	Kahua Ranch	Kahua Ranch	Agriculture	Grazing, diversified agriculture wind energy
	Others	Bishop Estate Hawaiian Homes Parker Ranch		
Maui	W. Maui	Maui Land & Pineapple	Agriculture	Grazing, tourist activities
	McGregor Point	State	Resource & general conservation	Grazing
	Puunene	State, HC&S	Agriculture	Sugar
	NW Haleakala	HC&S	Agriculture	Sugar

LAND-USE CHARACTERISTICS OF POTENTIAL PROJECT SITES

	Sites	Owner	Zoning	Current/Planned Uses
Molokai	W. Molokai	Molokai Ranch	Agriculture	Grazing
Lanai	Shipwreck Beach	Castle & Cooke	Agriculture	Grazing
Oahu	Kahuku	Campbell Estate	Agriculture	Wind energy, aquaculture military training
	Kaena Pt.	State	Agriculture	Military communications
Kauai	Anahola	Hawaiian Homes, C. Brewer	Agriculture	Agriculture, some residences
	Port Allen	State	Urban	Recreation, aviation
	N. of Hanapepe	Gay & Robinson	Agriculture	Grazing

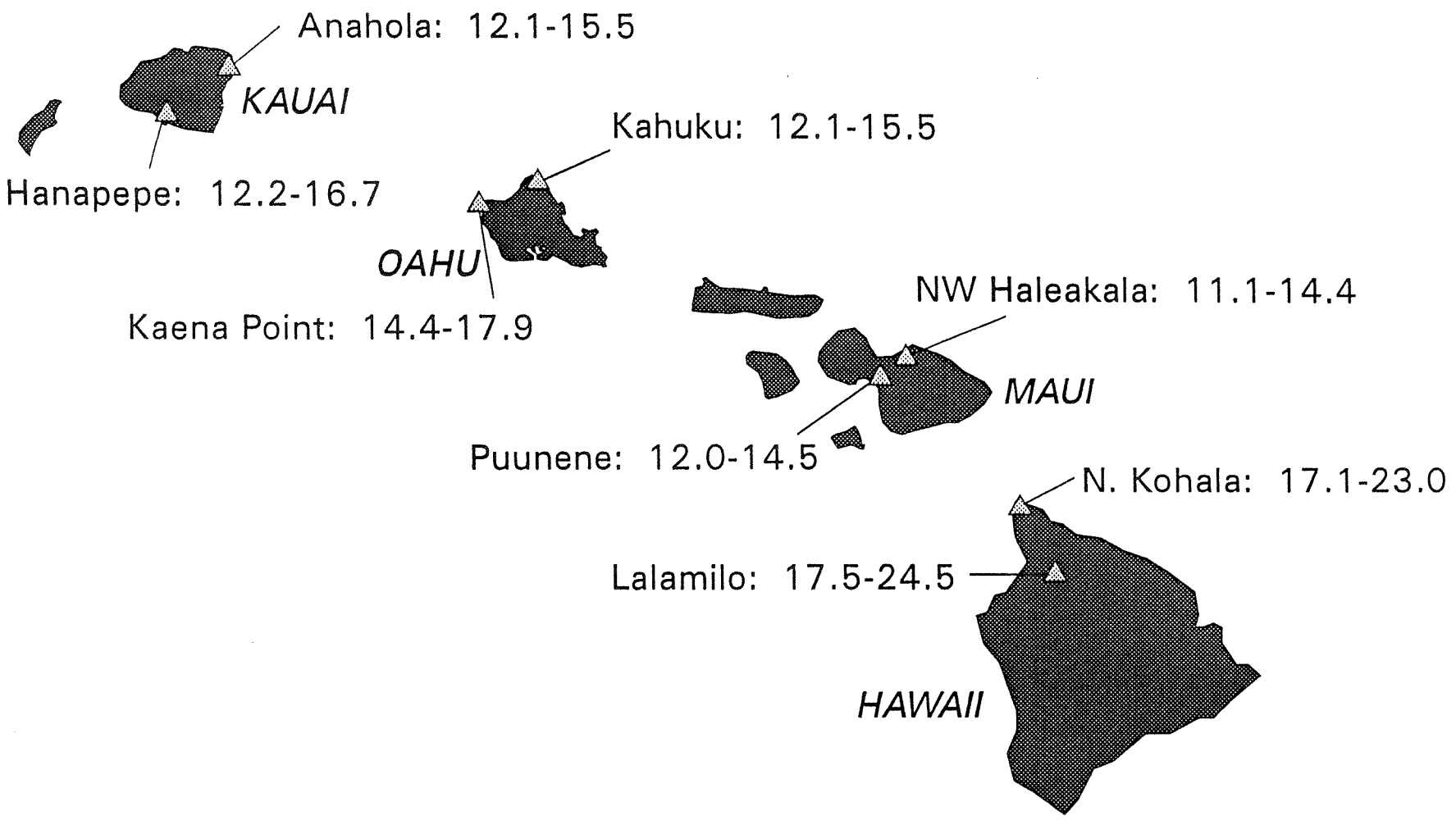
POTENTIAL PROJECT SIZES AND LIMITATIONS

Hawaii	Lalamilo	3 MW (existing transmission) 30 MW (utility) 50 MW (land)
	N. Kohala	5 MW (existing transmission) 15 MW (land)
	Kahua	5 MW (existing transmission) 15 MW (land)
Maui	W. Maui	10 MW (land) 30 MW (existing transmission)
	McGregor Point	10 MW (land)
	Puunene	10 MW (existing transmission) 30 MW (land + utility)
	NW Haleakala	10 MW (existing transmission) 30 MW (utility) 50 MW (land)

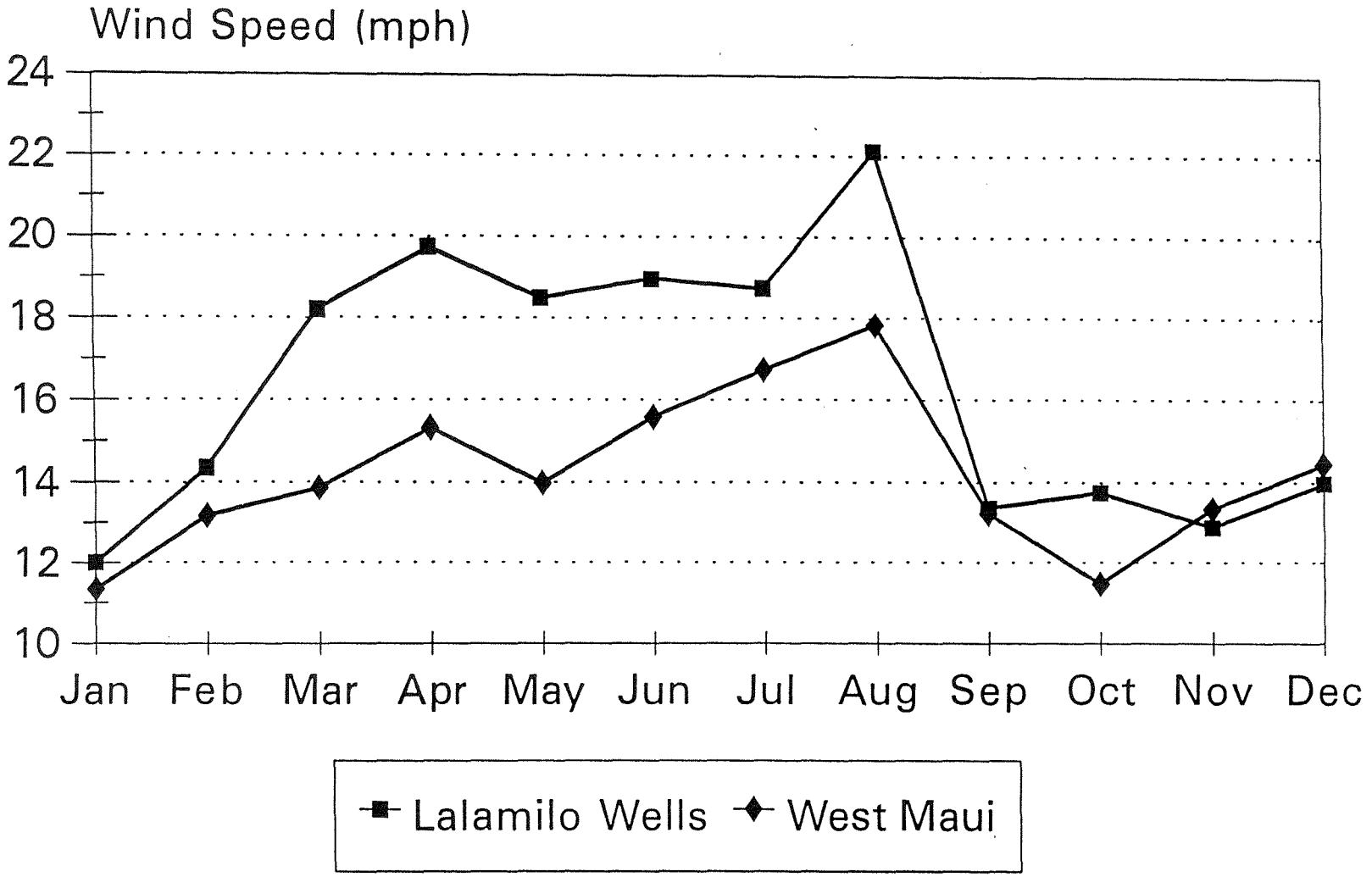
POTENTIAL PROJECT SIZES AND LIMITATIONS

Oahu	Kahuku	30 MW (existing transmission) 50 MW (utility)
	Kaena	2 MW (existing transmission) 15 MW (land)
Kauai	Anahola	7 MW (land & utility)
	N. of Hanapepe	10 MW (existing transmission)
	Port Allen	5 MW (land + existing transmission)

PRELIMINARY RESULTS FROM NEW MONITORING STATIONS
Range of Monthly Averages (Oct. '93 - Feb. '94 (mph)



SEASONAL VARIATION
7/92-6/93



LAND USE ISSUES

- Zoning
- Compatibility with existing or planned uses
- Impacts on land
- Impacts on wildlife
- Cultural/historical sensitivity
- Visual impacts
- Noise
- Uses of adjacent land
- Economics/competing uses

SUMMARY

- Good wind resources exist on all major Hawaiian islands
- Land use concerns limit potential development areas
- But -- potential wind energy development areas exist on all major islands on both state and private lands

2.2.2 Panel Members:

Dick Cameron–Alexander & Baldwin, Hawaiian Commercial & Sugar
Monty Richards–Kahua Ranch Limited
Mason Young–State of Hawaii Department of Land and Natural Resources

Panel Responses

Dick Cameron –Alexander & Baldwin, Hawaiian Commercial & Sugar (HC&S)

Mr. Cameron introduced himself as a representative of the agriculture industry participating in the workshop to share his perspective on the current usage of the land, particularly the central valley of Maui where HC&S currently occupies a primary portion of the land. He added that Alexander & Baldwin is open to the development of renewable resources citing the joint cooperative effort HC&S is involved in with the state and federal governments to build the biomass gasifier facility on HC&S land in Kahalui, Maui.

One of the key areas of concern in Hawaii, centers around the limited land resources available in Hawaii. A wind farm would be particularly visible in the central valley of Maui. The visibility impact from the general population is a major issue as HC&S experienced in the entitlement and gaining of permits for the biomass gasifier facility. The trauma suffered in erecting the BGF, put the project years behind schedule in construction.

Cost-effectiveness, long term reliability, predictable fuel sourcing, all pale in comparison to the visual impact issue, according to Mr. Cameron.

The value of the land and the installation of a wind farm leaves a very small footprint in comparison to the footprint of the land around it. The land impacted by the installation is a vast area, he emphasized, and it has a very, very large impact. It limits what you can do and needs to be put into perspective with other competing land uses.

In closing, Mr. Cameron predicted that it will be the visual environmental issues in Hawaii that will be the most difficult to combat in developing wind in the state.

Monty Richards – Kahua Ranch Limited

In Kahua, the wind always blows which is why Kahua Ranch got into the business of wind power, Mr. Richards stated. From an agricultural standpoint, wind is not an asset but a liability. As for ranching, Mr. Richards said in referencing Mr. Cameron's statements, wind was not an *either/or* competing land use but an *"and"* situation. However, due to the ravages of old technology and strong winds, the wind farm at Kahua Ranch is temporarily in demise with only a few Jacobs wind turbines still in operation.

Any diversification of business at Kahua Ranch would require power, Mr. Richards noted, adding another reason for the development of wind was to ease the requirement of power from the utility and thus lower their power costs.

"We are presently in the greenhouse business and if it was not for the few wind turbines we have left, we would not be in the greenhouse business," he said.

Echoing the words of Dick Cameron but from a different perspective, Mr. Richards emphasized that a team approach is needed in Hawaii to make the development of wind a success. The team players are as follows:

- Landowners - a substantial commitment is needed for a 20 to 30 year usage of land for wind development.
- Government - support is needed not only for research but for resolving zoning requirement disputes as well as providing legislative support. (Currently Mr. Richard's land in Kahua is being considered for a change in zoning from agriculture to conservation, therefore he has been forced to stop negotiations with Zond Systems until the issue can be resolved. Mr. Richards views the zoning change as a threat and countered by filing a request with the county to subdivide Kahua Ranch into 20 acre lots zoned agriculturally.)
- Environmental Groups - do they want wind to be developed or are they going to fight it?
- Public - support is currently strong.
- Manufacturers - need to produce a high performance machine.

"It's not going to be easy if you're going to have to fight your way, every step of the way. We have done battle and will continue to do battle but the old war horse is getting tired," he said noting that despite the hardships endured his spirit is not broken and Kahua Ranch will continue to support wind development in Hawaii.

In emphasizing the team approach, Mr. Richards outlined a few key points for all concerned to keep in mind:

- Approach a wind program from a long term perspective rather than a short term perspective.
- Make certain that the program implemented for wind is financially rewarding.
- Make certain that the development of wind in Hawaii is implemented for the good of the state as well as for private developers.

Mason Young – State of Hawaii Department of Land and Natural Resources

Mr. Young reiterated the need for a joint venture to implement wind in Hawaii. Without it, he added, it will never work.

With over 1.4 million acres in its possession, the state is the largest landowner in Hawaii, Mr. Young noted.

The state has many potential sites for wind development, he said and cited several wind project sites on the islands. However, the major problems for wind development in Hawaii are cultural and environmental opposition. Listing a variety of obstacles to establishing a wind farm ranging from cultural conflicts with sovereignty groups and OHA to legislative hurdles, Mr. Mason again emphasized the need for a joint venture with all the team players.

"We have the land for wind development but we have a battle in front of all of us. If we don't have team players, we don't have anything," he said.

The biggest player in the joint venture is the utility that buys the power and can readily provide purchase power agreements, according to Mr. Young.

In addition, he added that credibility is needed to show that the source is competitive and viable in the market. And finally, visual impact is a major issue as well.

"Let's be honest with each other," he said in closing, "a site location is only a dream until you figure out how you are going to reconcile it with all the parties concerned."

Questions and Answers

Question:

Is there data available on wind resources at site locations across the islands on short times, e.g. minute to minute.

Answer:

Karen Conover – R. Lynette & Associates

Because the winds in Hawaii are trade winds, sites have similar patterns across the islands. Ms. Conover added that data on shorter time scales is available should the interested party request copies.

Question:

What is the range in which wind correlates to load requirements in Hawaii?

Answer:

Karen Conover – R. Lynette & Associates

The wind is pretty consistent throughout the day except in the afternoon when it peaks.

Warren Bollmeier – PICHTR:

There is a significant problem, particularly on the Big Island, of excess loads at night from wind. There is a problem in that regard with hydro too, Mr. Bollmeier said, adding that the issue would be discussed in a subsequent session of the workshop.

Question:

What is the best way to engage the cultural interests in a wind project?

Answer:

Mason Young – State of Hawaii Department of Land and Natural Resources:

Involvement is key, according to Mr. Young. Go out to the affected community and neighborhood boards and sell your project. If you don't sell it, you don't get anywhere, he said. Be up front. Show how it benefits the community, and more importantly, work at a *win win* approach to show how the community will benefit. If they feel they are a part of the project and they are going to get something from it, you will have a much better chance of succeeding.

Dick Cameron –Alexander & Baldwin, HC&S

In echoing the thoughts of Mason Young, Mr. Cameron urged developers as they go out to market their project, to keep in mind that, in Hawaii, profit motivation does not sell a project.

This is a very difficult perspective to assume as suppliers and investors, according to Mr. Cameron. It becomes necessary to have tenacity as we look forward to projects that have as much community impact that wind farm projects will have on our very, very small island state.

Question:

Which is easier to site, a coal plant or a wind farm and why?

Answer:

Dick Cameron –Alexander & Baldwin, HC&S

Coal is easier to site because coal plants are:

- small, thus no visual impact,
- predictable as far as emissions are concerned,
- furnish power when you need it on a continuous basis, and
- coal is a known commodity.

When asked which would generate more public support, a coal plant or a wind farm, Mr. Cameron stated that there are coal plants on Maui but there are no wind farms.

Monty Richards – Kahua Ranch

"From my perspective," Mr. Richards said, "We could site a wind farm on my ranch easier than we could site a coal plant and I think the public would buy it."